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NDUSTRIAL ARTS AND VOCATIONAL EDUCATION

The Shop Teachers' Professional Magazine

SCHOOL SHOP ANNUAL

Need this fact surprise any witness of the Union?

"Taffy" pulled by girls bouncing putty, General Ele tric development. Silicon are unaffected by temperatu as low as 55 below zero an as high as 520 F., may rev lutionize plane, tire and pai performance.

GLASS, flint and quartz are three pretty hard substances, nothing at all like the "taffy" the girls in the picture above are pulling with such fun. Nor can you wad up glass like wax and bounce it like a tennis ball, as these girls can with their taffy.

Yet glass, flint, quartz and the plastic, elastic taffy are made up largely of silicon. The day-and-night difference is the result of what happened during the "youth" of the substance. Need this surprise anyone who looks at the electron and proton, the fruit of whose union is everything in the universe?

The principle of infinite possibilities embraces everything in the universe, including mankind. That *more* boys don't grow up to be successes in the business of life is the surprising thing . . . and is attributable chiefly to the absence of certain influences in their lives. This fact, becoming more and more apparent, also becomes the chief concern of wise and responsible educators who seek constantly to supply the missing influences.

The need is as pressing, the opportunity is as great in the class in mechanical drafting as anywhere else in the curriculum. Here, the work points directly at the adult years, the classroom foreshadows the engineering office. Above all, here the work combines discipline of the hand and discipline of the mind. Great opportunity to enthuse and inspire the beginning student, to awaken dormant ambition for high achievement, to initiate habits which will serve him well is here presented. To say at this time it does not matter what quality of drawing instruments the student uses, to say his drawing set can be carelessly chosen, regarded with indifference, is to make this work an ill-starred venture . . . is a risk no conscientious instructor will take. The only possible reason for accepting less than the best is an economy of pennies gained at who knows what cost in the future.

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ENGINE LATHES • TOOLROOM LATHES • TURRET LATHES • ATTACHMENTS

No. 1001-Z SOUTH BEND TURRET LATHE

14" x 6' SOUTH BEND TOOLROOM LATHE

10" x 3½' SOUTH BEND TOOLROOM LATHE

13" x 5' SOUTH BEND TOOLROOM LATHE

9" x 3' SOUTH BEND MODEL A BENCH LATHE

14½" x 5' SOUTH BEND ENGINE LATHE

TEACHING HELPS FOR SHOP CLASSES

Manuals, sound films, wall charts, booklets, and other teaching and study helps on the operation and care of metal working lathes are available to shop instructors, supervisors, and trainees. Write today for free Bulletin No. 21 which illustrates and describes this valuable educational material!

The outstanding records for performance and dependability which South Bend Precision Lathes have achieved under the critical demands of American industry recommend them for student training purposes in the school shop. Performance and dependability, plus ease of control, simplicity of operation, unfailing precision, unusual versatility, and built-in safety features, make South Bend Precision Lathes the logical installations for those school shops where the quality and thoroughness of training are principal considerations. Certainly it is to the students' advantage to learn in school to operate the lathes which they are most likely to use in industry.

WRITE FOR CATALOG 100-D

Illustrates in full color, and gives complete, detailed specifications of all types, sizes, and models of South Bend Precision Lathes; shows all South Bend lathe attachments and accessories. Mailed free on request.

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Center and Follower Rests

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Collets and Collet Sets

Handlever Bed Turret

Square Turret Tool Block

Double Tool Cross Slide

Double Tool Cross Slide

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, March, 1947, Volume 36, No. 3, Published monthly, except July and August, by The Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. Entered as Second-Class Matter January 2, 1914, at the Post Office at Milwaukee 1, Wis., under the act of March 3, 1879. Subscription price in the U. S., Canada, and countries of the Pan-American Union, $2.50 per year; Foreign, $3.00; Single copies, 35 cents.

FOR METAL

Walker-Turner Machine Tools provide extreme flexibility and high production speeds at a low original investment wherever metals, wood or plastics are drilled, cut or shaped. They represent the latest achievements in ease of handling and safety and may be operated as bench models, floor models, singly, in groups, or as special set-ups.

15″ DRILL PRESSES

BENCH MODEL D950

These 15″ Drill Presses are available in bench and floor models, all incorporating the efficiently designed Drill Head features — one-piece head casting, four ball bearings, six spline spindle.

Standard spindle speeds, with 1740 r.p.m. motor, 600, 1250, 2440 and 5000 r.p.m. Calibrated depth stop, positive locking device, 4-spoke pilot wheel feed, columns precision ground. Spindle travel 4¼″.

Drills to center of 15″ circle. *Ask for Bulletin No. 1201.*

BAND SAWS

Speeds adjustable; 14″ saw for metal for 61 to 4630 s.f.m.; 16″ for wood and plastics, from 200 to 5300 s.f.m. Tables, heavily ribbed, tilt to 45° and have mitre gauge grooves. 14″ Metal Cutting Band Saw—MBN935. Blade Speeds: 61 to 4630 s.f.m., Table size, 16″ x 16″. *Ask for Bulletin No. 1201.*

MBN 935

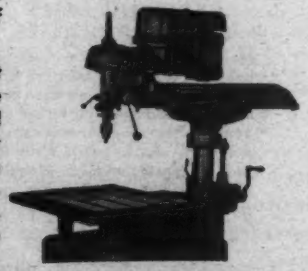
GRINDERS

Motors in these grinders are totally enclosed with special shaft seals to prevent abrasive dusts from damaging vital parts. Precision, dust sealed ball bearings are used. Model GR100, 1 h.p. Grinder shown has table and stand of heavy cast iron with a cooling well at front center. 1725 RPM with 60 cycle motor. Guards designed to latest safety code requirements have non-shatterable glass shields, removable for buffing operations. Wheels 10″ diameter by 1″ face x ¾″ bore. Adjustable tool rests, 10 amp. switch and 10″ cord and plug. Also available, GR50E with ½ h.p. and GR35E with ⅓ h.p. 10″ Grinder — GR100 — 1 h.p. — Speeds: 1725 r.p.m. with 60 cycle motor. *Ask for Bulletin No. 1201.*

RADIAL DRILL

An extremely versatile, speedy, accurate Radial for drilling, tapping, routing and light profiling. Does much of the work of radials costing 5 to 6 times as much. Drill head, ram and cradle are raised and lowered by crank-operated screw mechanism at top of column.

Head swings 180° to right or left and tilts at any angle from vertical to horizontal positions—can be operated at compound angles. Gliding ram travels 18″. Drills to center of 62″ circle. 16 spindle speeds from 110 to 830 r.p.m. *Ask for Bulletin No. 1201.*



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Walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

Walker-Turner MACHINE TOOLS

FOR WOOD

A brief description of a few of the standard machines is given. More complete information is available in the individual catalogs. See below. The Walker-Turner distributor near you is a specialist in machine tool applications and can help you make a selection for your school.

VARIABLE SPEED LATHE

Headstocks have two sets of pre-loaded precision ball bearings with deep groove races. Ample overload capacity for both thrust and radial loads is provided.

Adjustable tool rest bracket of new design provides smooth, quick action, with fast changes and positive locking.

Swing over bed, 12"; over gap 15"; distance between centers 38". Speeds, two inch pulley, 240 to 2,000 r.p.m. With 4" pulley, 460 to 3750 r.p.m.

The spindle speed may be set by the hand wheel and the control locked in position. Speed cannot be changed without unlocking the control. *Ask for Bulletin No. 1251*

TILTING ARBOR SAW

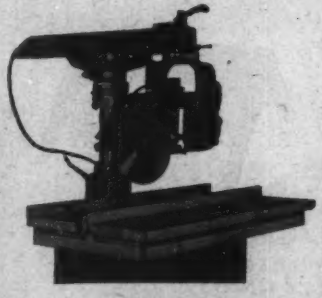
For greater utility and convenience this 10" Tilting Arbor Saw incorporates several exclusive features.

A magnetic overload protection switch with single phase motors, Vernier adjustment of the ripping fence, convenient locking lever releases or locks the fence in less than a half turn.

New tilting assembly, perfectly balanced and so designed that it cannot be sprung or twisted out of alignment. Full 3" depth of cut, angle cuts to 45°; tex-rope drive. *Ask for Bulletin No. 1252.*

RADIAL SAW

The Walker-Turner Radial Saw can work wonders wherever ripping, mitering, shaping, tenoning, dadoing, routing or a hundred other jobs are performed. The self cleaning sliding ram with eight ball bearings provides ease of manipulation and full visibility at all times. Patented geared motor allows smaller blades and greater sawing capacity with less power per cut.

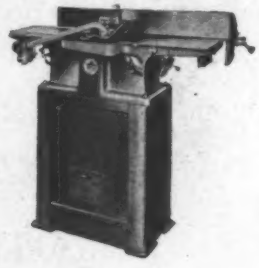


Motor unit tilts vertically and swings horizontally for any angle bevel, mitre, or compound cut—also operates at 90° for shaping, tenoning and routing. Cuts materials up to 4¾" deep. Gliding ram travels 21½". Rips material 38" wide. *Ask for Bulletin No. 1203.*

JOINTERS

The guard on this 6" De Luxe Model Jointer performs a double function. The work may be fed under it while the operator's left hand, resting on the guard applies the necessary amount of pressure. Wood can be planed down to ribbon thickness with absolute safety.

Texrope drive with triple V belts permits highly efficient, close-coupled motor connection. Hinged fence is equipped with quick-action release lever. Heavy, accurately machined table mounted on dovetail ways with adjustable gibs. Approved 3-knife cutterhead. Rabbeting capacity up to ½". Speed: 4200 r.p.m. *Ask for Bulletin No. 1253.*



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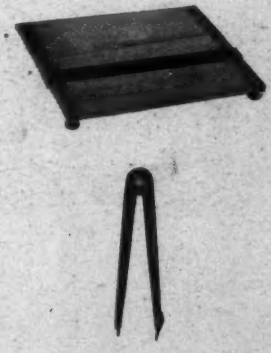

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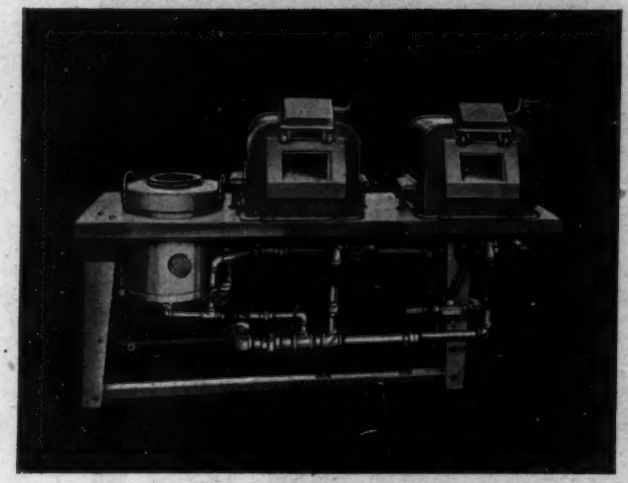
SUNBEAM STEWART INDUSTRIAL FURNACE EQUIPMENT



SUNBEAM STEWART TRIPLE-PURPOSE FURNACES

Because of its wide range of usefulness the Sunbeam Stewart Triple-purpose Furnace (E), shown at the left, designed for operation on gas at ¼ lb. pressure and air at 1 lb. pressure, is a basic metalworking unit for school or small shop work. It combines three of Sunbeam Stewart's most popular small furnaces: (1) No. 28 Oven (temperature range 1400° to 1800°), (2) No. 28C Oven (temperature range 1800° to 2400°), (3) B612 Pot Furnace (temperature range 400° to 1600°). To supply the air required, the Turbo-blower shown mounted on the unit has been found most satisfactory. Because of the precise requirements of today's heat treating, temperature-indicating equipment is recommended. A single pyrometer instrument can be used with a thermocouple selector switch, and a thermocouple with lead wire for each of the three furnace sections.

HEAT TREATING OPERATIONS OF THE SUNBEAM STEWART TRIPLE-PURPOSE FURNACE

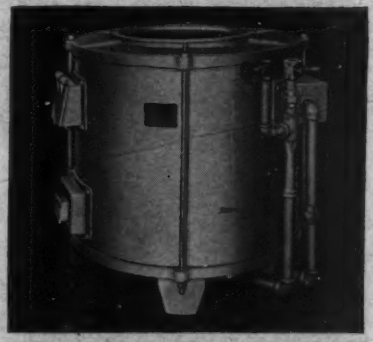
Oven Furnace Hardening Carbon Steels . . . in No. 28 Oven Section.
Lead, Salt or Oil Tempering Carbon Steels . . . in B612 Pot Section.
Oven Furnace Preheating High Speed Steels . . . in No. 28 Oven Section.
Oven Furnace Hardening High Speed Steels . . . in No. 28C Oven Section.
Lead or Salt Drawing High Speed Steels . . . in B612 Pot Section.
Pack Carburizing or Hardening . . . in No. 28 Oven Section.
Cyaniding, Lead or Salt Hardening . . . in B612 Pot Section.
Annealing . . . in No. 28 Oven Section.
Melting Lead, Zinc, Babbitt, etc. . . . in B612 Pot Section.
Melting Brass Bronze, etc. . . . in B612 Pot Section (with crucible).

SUNBEAM STEWART SMALL SEMI-MUFFLE FURNACES AND ROUND POT TEMPERING FURNACES

(For heat treating larger parts, Sunbeam Stewart small Semi-muffle Furnaces are available with work chambers as large as 6" high x 12" wide x 22" long. These furnaces are the same general design and specification as sections 28 and 28C of the Triple-purpose Furnace shown above.)

SMALL SEMI-MUFFLE FURNACE

Handy, compact general purpose furnaces widely used in small shops, tool rooms, and schools for a wide variety of work such as annealing, carburizing, hardening, and general heat treating. They are quickly brought up to heat, making them particularly desirable for intermittent use. With their standard heavy duty molded linings they are easy to maintain and operate. The large number of burners on gas-fired units firing underneath semi-muffle hearth provide maximum temperature uniformity and production. Available in several standard hearth sizes as large as 12" x 22".



ROUND TEMPERING FURNACE

Following the hardening of the work in the Sunbeam Stewart small Semi-muffle Furnace shown above, the work should be tempered, drawn, or stress relieved in a Sunbeam Stewart Round Tempering Furnace, using oil, lead or salt in the heating bath. These furnaces are available with pots from 12" to 18" in diameter, and from 12" to 20" deep in standard sizes. Standard temperature ranges are 400° to 800°, or 800° to 1200°. Combinations of these ranges are also available.

FOR SCHOOL SHOP METALWORKING REQUIREMENTS

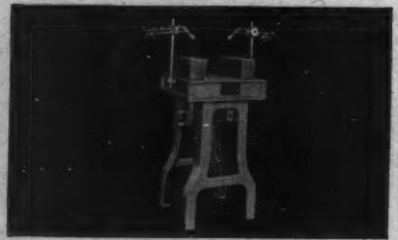
SUNBEAM STEWART SMALL FORGE FURNACES

Where training in modern forge practice is given, these small Sunbeam Stewart Forge Furnaces are standard equipment in many technical schools and colleges. They are ideal for general forging, forming, and tool dressing work. Sturdily constructed, and highly efficient in operation, with uniform, quick heats. The linings are simple and easily maintained, yet efficient and enduring. Designed for operation on gas at ¼ lb. pressure only, and also require air at 1 lb. pressure. Since the temperatures at which the operations are done are usually not critical, pyrometer equipment is not required.

SUNBEAM STEWART NON-FERROUS METAL MELTING FURNACE

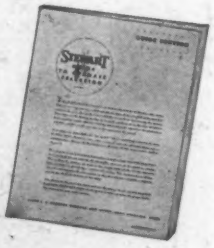
These furnaces are designed for the melting of brass, aluminum, tin, nickel alloys, copper, copper alloys, gold alloys, magnesium, zinc, lead, cadmium, nickel-silver, bronze, beryllium, antimony, etc. Widely used in school and shops for many small casting jobs. The swinging top made of one piece of molded refractory, banded to add strength, lifts easily from the body of the furnace by means of a special mechanism, and swings to one side, giving a clear opening into the body of the furnace—a feature much appreciated at casting time. The linings are of high grade refractory material, sufficiently heavy to resist the abrasive action of the swirling flame which the burners set up. They are available in several sizes, with crucible capacities from 12, 36 and 105 lbs. of brass up. The smallest size is designed for gas only; other sizes can also be supplied for oil fuel. All sizes require air at 1 lb. pressure. Ordinarily no pyrometer or temperature-measuring equipment is required.

SUNBEAM STEWART BRAZING TABLE



For many general gas brazing jobs, low temperature welding work, and other school and shop needs, this Sunbeam Stewart Brazing Table has proven very satisfactory in hundreds of installations. The blow pipes are pivoted and hinged so blast may be directed at any angle from either nozzle and concentrated at any spot. Blow pipes can be equipped with special nozzles for specific operations as required.

Get Your FREE Copy of Guide to Furnace Selection



For instruction purposes, copies of the Sunbeam Stewart Guide to Furnace Selection is available without charge to educators. This guide can be used to find quickly the type of gas or oil-fired furnace best suited to any work. This guide is also intended to assist in finding the heating time required, the heating medium to be used, and from these, the type of furnace best suited for a particular heat treating operation with regard for the production required and the weight and size of the material to be heated.

SUNBEAM STEWART INDUSTRIAL FURNACE DIVISION

SUNBEAM CORPORATION (formerly Chicago Flexible Shaft Co.)
4433 OGDEN AVENUE, CHICAGO 23, ILLINOIS
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The widespread use of WESTON instruments in vocational education has become a fixed principle...primarily because these are the measurement standards so widely used throughout industry. Thus the student becomes thoroughly familiar with the instruments he will use throughout his industrial career. They are preferred, too, because they inspire students to be more exacting in their work, and because they represent a truly sound investment...combining ruggedness, dependability and long life.

Following is a condensed listing of the WESTON instruments available . . . also are illustrated a few of the models most widely used in educational work. Complete information on any WESTON instrument is available and will gladly be sent on request. Write to . . . Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark 5, New Jersey.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
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RELAYS
Sensitive and Power Uses — Current and Voltage Types

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Portable — Potential and Current

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types — Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Ohmmeters

PHOTOELECTRIC CELLS
"Photronic" Cells — Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Illumination Controls

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters, Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE — Remote Indicating
BIMETALLIC TYPE — Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

STANDARD CELLS

**Photronic—A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

Model 703
Sight Meter

Direct-reading pocket size meter calibrated to measure light values in foot-candles, and "seeing tasks." Equipped with Weston VISCOR filter it measures the visual intensity of all common lighting sources without correction factors.

Model 430
Portable, Precision A. C. and D. C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.

Model 779 Type 1
Super-Sensitive Analyzer

Small, light, sturdy . . . has 25 carefully selected voltage, current, resistance and decibel ranges. Ideal for measurements in tube circuits, transmitters, electronic controls, audio and communications equipment, condenser leakage, etc., etc. D.C. sensitivity 1000 or 20,000 ohms per volt.

WESTON *Instruments*

Model 489 and 528
Small A. C. and D. C. Instruments

Small, sturdy, inexpensive . . . for all-around A.C. and D.C. testing where moderate accuracy is sufficient. Available in Voltmeters, Ammeters, Milliammeters. A.C. models available in single, double and triple ranges.

Model 375
Student Galvanometer

Ideal for schools, where durability and moderate cost are essential. Sensitivity approximately 22 microamperes per division, resistance about 23 ohms. Zero center scale, calibrated 30-0-30 in millimeter divisions. Other sensitive models also available.

Model 280
Miniature D. C. Instruments

Miniature precision D.C. instruments, with hand calibrated mirror scales and knife edged pointers. Available as voltmeters, ammeters, voltammeters, milliammeters and millivoltmeters.

Model 798
Tube Checker

—proportional mutual conductance tube checker — tests all commonly used receiving tubes. Scale calibrated "Good-Bad" as well as mutual conductance. Includes various AC and DC voltage, DC current, and resistance ranges for circuit checking.

Teaching Different Drilling Jobs Every Day?

HERE'S THE TOOL FOR YOU!

Black & Decker ½" Standard Portable Electric Drill

It Drives:

Twist Drills

Wood Augers

Hole Saws

As Portable Drill — As Drill Press

VERSATILE Black & Decker ½" STANDARD Electric Drills make more realistic demonstrations and encourage better shop practice on the many drilling jobs that must be handled in vocational training. They're fast, full-powered, flexible . . . easy for students to operate . . . ruggedly built to stand up under inexperienced handling. They drive twist drills up to ½" in steel . . . wood augers up to 1" in hardwood . . . Hole Saws up to 3½" diameter for cutting clean, round holes in any material a hacksaw will cut.

Moreover, Black & Decker ½" STANDARD Drills are equally useful when operated as powerful drill presses! Mounted in a Black & Decker Drill Stand, they have 6-to-1 leverage to put on the pressure when needed . . . a smooth, positive feed for more precise work . . . one-hand operation that makes it easier for students to guide the workpiece.

Check your nearby Black & Decker Distributor today for complete information on these Drills . . . or for help on any tooling problem. For your free copy of our latest catalog, containing details on more than 100 Portable Electric Tools and their many attachments that can help your training program, write to: The Black & Decker Mfg. Co., 680 Pennsylvania Ave., Towson 4, Maryland.

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PORTABLE ELECTRIC TOOLS

AIRCO

Your supply depot for

Gases

Airco Oxygen is produced and tested under the most rigid scientific procedures, and is guaranteed to be 99.5% pure in the cylinder. High purity assures maximum speed and economy in cutting, and greater efficiency in welding.

Airco Acetylene has been proved by use and tests to be the most economical fuel gas for pipe welding and other flame welding operations.

Other Airco gases such as Nitrogen, Hydrogen, Carbon Dioxide and the rare gases Argon, Neon, Helium, Xenon, and Krypton (and mixtures thereof) for commercial and laboratory use are available through a nationwide distribution system. Nitrogen and Oxygen may be obtained in liquid state and Carbon Dioxide in solid form.

National Carbide (in the red drum) is made from the finest available coke and limestone by the most modern manufacturing methods. It is evenly sized and dust-free, and gives a high, uniform yield of acetylene gas. Available in six sizes in 100 lb. and 25 lb. drums, and 2 lb. and 10 lb. cans.

Tensile Test Machine

Oxyacetylene Apparatus and Supplies

Airco manufactures and distributes a complete line of products for every oxyacetylene flame use. Among these many products are:

Airco Tensile and Bend Testing Machine: This newly designed machine permits rapid testing of weld specimens in shop, laboratory, or on field operations. Guided bend tests, transverse tension, and longitudinal all-weld metal tension tests are quickly made with this compact Airco machine.

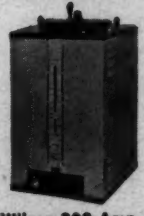
Airco Hand Torches: Airco torches are made in a complete line of types for gas welding, cutting and many other oxyacetylene flame applications. Precision-made from the finest materials available, Airco torches have been noted for over 25 years for sturdiness, efficiency, and scientifically-balanced construction. A complete line of tips is also available.

Airco Gas Pressure Regulators: Airco gas pressure regulators are made in a wide range of styles for controlling gas pressures in cutting, welding, and other oxyacetylene processes. They are available in styles for use with oxygen, acetylene, hydrogen, nitrogen, carbon dioxide, and other commercial gases. Ruggedly constructed, accurate, and dependable, Airco regulators are designed to give long, reliable service.

Gas Welding and Cutting Supplies: Airco also provides a complete line of supplies for every oxyacetylene flame application—welding rods, flux, hose, goggles, gloves and many others. Whatever you need for gas welding and cutting, Air Reduction can meet your requirements promptly.

Arc Welding Machines, Electrodes and Accessories:

The Wilson "Hornet", famous for its smooth, steady arc, easy regulation, and reliable service, is ideal for general purpose DC welding. Made in 200, 300, 400 amp. sizes.



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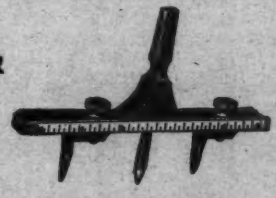

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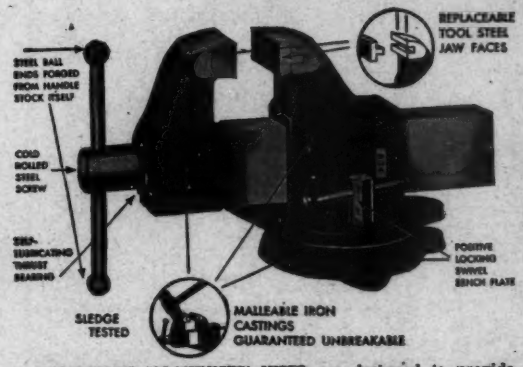
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504	4	6	36
504½	4½	7	47
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605	5	8	70
606	6	10	106

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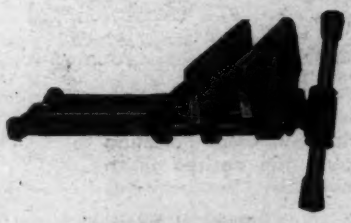

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Weight, lbs.	24	32	25	33

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Jaws Open, in.	9	12	9	12
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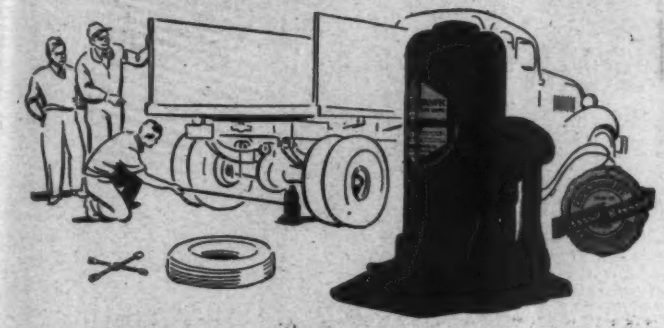

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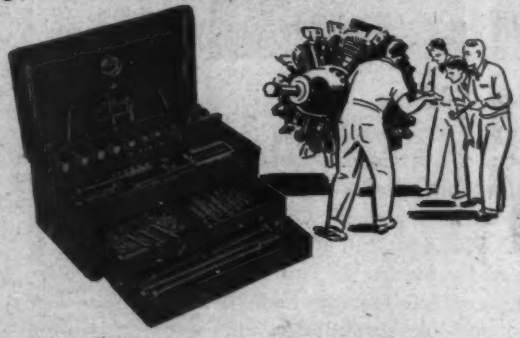

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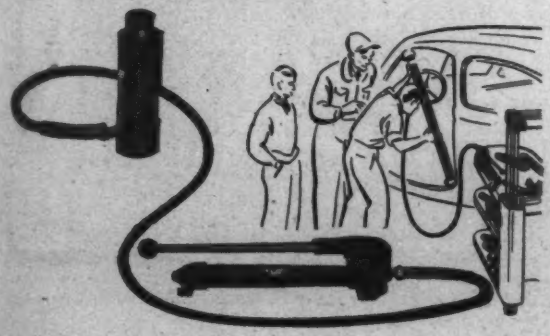

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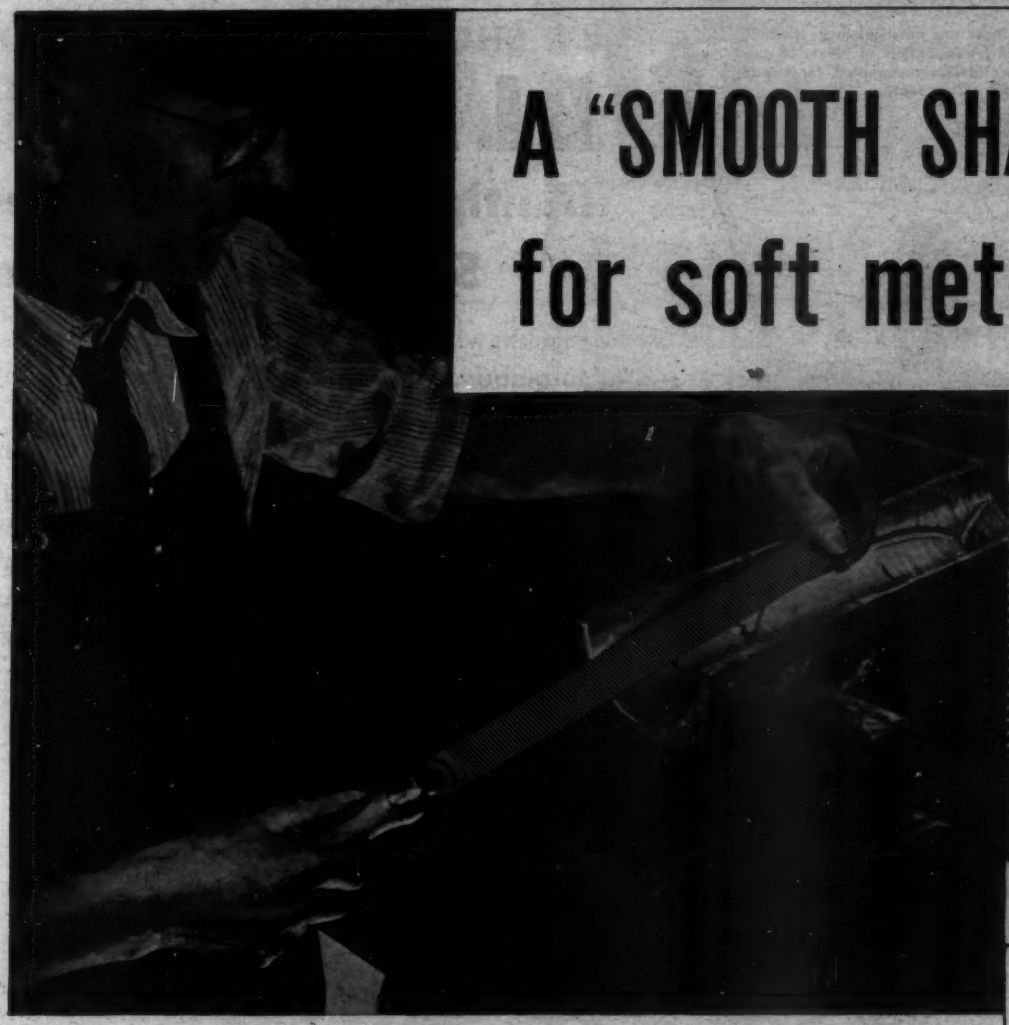

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▶ The 1947 School Shop Annual

As in previous years, the present *School Shop Annual* presents a number of articles that should be very helpful to anyone engaged in planning or equipping school shops. They will be equally helpful to those who contemplate the rearrangement of existing shops.

The first nine articles will be found especially pertinent to those who are engaged in shop planning.

The three articles, "Organization of Related Instructional Materials for Apprentices," "Vocational Guidance Research in the Industrial-Arts Laboratory," and "Industrial Arts — A Professional Accounting," will also be found very thought provoking.

The classroom teacher interested in tests and in problems and projects also has been taken care of.

The entire content of this issue has been carefully selected with the hope that it will serve the readers of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION in the best possible manner.

▶ Coming Conventions

March 23–26. Association for Supervision and Curriculum Development (Division of N.E.A.) at Chicago, Ill. Headquarters, Sherman Hotel.

April 3 or 4. Tennessee Vocational Association at Knoxville, Tenn.

April 7–10. New York State Vocational and Practical Arts Association at New York City. Secretary, M. B. Galbreath, Morrisville Technical Institute, Morrisville, N. Y. Headquarters, Hotel Pennsylvania.

April 10–12. Illinois Industrial Education Association at Peoria, Ill. Secretary, Louis V. Newkirk, 228 No. LaSalle St., Chicago, Ill.

April 10–12. Michigan Industrial Education Association at Detroit, Mich. Secretary, Arthur L. Reagh, 143 Bostwick, N.E., Grand Rapids 3, Mich. Headquarters, Cass Technical High School.

April 10–12. Eastern Arts Association at Philadelphia, Pa. Secretary, Mrs. Lillian D. Sweigart, State Teachers College, Kutztown, Pa. Headquarters, Benjamin Franklin Hotel.

April 24–26. American Industrial Arts Association at Columbus, Ohio. Secretary, John J. Hatch, 185 Broadway, Newark 4, N. J. Headquarters, Neil House.

April 30–May 3. Western Arts Association at Cleveland, Ohio. Secretary, Harold W. Hunsicker, 1649 Elberow Ave., East Cleveland, Ohio. Headquarters, Hotel Cleveland.

▶ This Month's Cover

Our cover picture for this month shows a scene from one of Chicago's industrial arts laboratories. The photograph was submitted by Dr. Louis V. Newkirk, director, Bureau of Industrial Arts, Chicago Public Schools.

VOL. 36, NO. 3 MARCH, 1947

Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

THE BRUCE PUBLISHING COMPANY
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TABLE OF CONTENTS

▶ Shop Planning and Organization

Shop Planning for the Small High School ... *Sylvan A. Yager and Fred J. Schmidt, Jr.* 87
A Plan for the Small General Shop ... *Chris H. Groneman* 92
Poor Teacher ... *Leonard E. Schmidt* 95
Shop Layouts ... *G. Wesley Ketcham* 95
High School Shop Layout ... *Carlin Aden* 96
Efficient Graphic-Arts Departments ... *John A. Backus* 97
Color in the School Shop ... *Joseph C. Thompson* 98
Installation and Maintenance of Woodworking Equipment ... *Robert E. Holland* 101
Junior High School Metal Shop Equipment ... *Merritt E. Melberg* 103
The Creative Laboratory or Handicraft Shop ... *Ferdinand V. Liotta* 106
Organization of Related Instructional Materials for Apprentices ... *Claude H. Ewing* 112
Vocational Guidance Research in the Industrial-Arts Laboratory ... *Isadore M. Fenn* 115
Industrial Arts — A Professional Accounting ... *R. Lee Hornbake* 118
Joe ... *Leonard E. Schmidt* 34A
Being Resourceful ... *Delmar W. Olson* 48A

▶ Testing and Tests

Multiple-Response Test for Students of Drafting ... *C. H. Schubert* 139
General Printing Project Test ... *Israel Bensman* 140
Test for Mechanical Drawing I ... *Frederick Neuschel, Jr.* 30A

▶ Problems and Projects

Nature Study Alphabet ... *F. N. Newton, Jr.* 121
Data Tables for Drafting Room ... *H. D. Campbell* 122
Machinist Hand Vise ... *Nathan Bogoch* 126
Fundamentals of Blueprint Reading ... *C. H. Niemann* 127
To Darken the Classroom ... *D. F. Schutte* 129
Knob Designs for Small Projects ... *Harold S. Beal* 130
Leg Rest ... *Lyle M. Garnett* 131
Hand-Built Pottery ... *Edgar H. Strong* 132
Lapel Pin — Dog ... *Abraham G. Beleson* 133
The Art of Getting Along ... *Edward C. Estabrooke* 134
Castolite Projects in the Industrial-Arts Shop ... *William Weers* 134
Letter Holder ... *Charles L. Frank* 136
Our Lumber Supply ... 136
Furniture Patching ... *Harold L. Round* 137
Project Sheet — Sailboat Mantelpiece ... *Clifford L. Yard* and *Henry J. Kaufman* 137
The Care of Paintbrushes ... *E. Kurath* 138
Sample Operation Sheet for the Print Shop ... *Norman Crouch* 138
Handy Tray and Table ... *Nathan Bogoch* 20A
Synthetic Resin Glues for Wood ... *John Paustian* 42A
The Use of Glue in Woodworking ... *Wilbur L. Jones* 46A

▶ Equipment and Supply List

Metalworking ... 36A
Automotive ... 44A
Electricity ... 50A
Woodworking ... 54A
Print Shop ... 68A
Drafting ... 70A
Personal News ... 55A
Association News ... 58A
Shop Equipment News ... 64A
News Notes ... 68A
New Publications ... 75A

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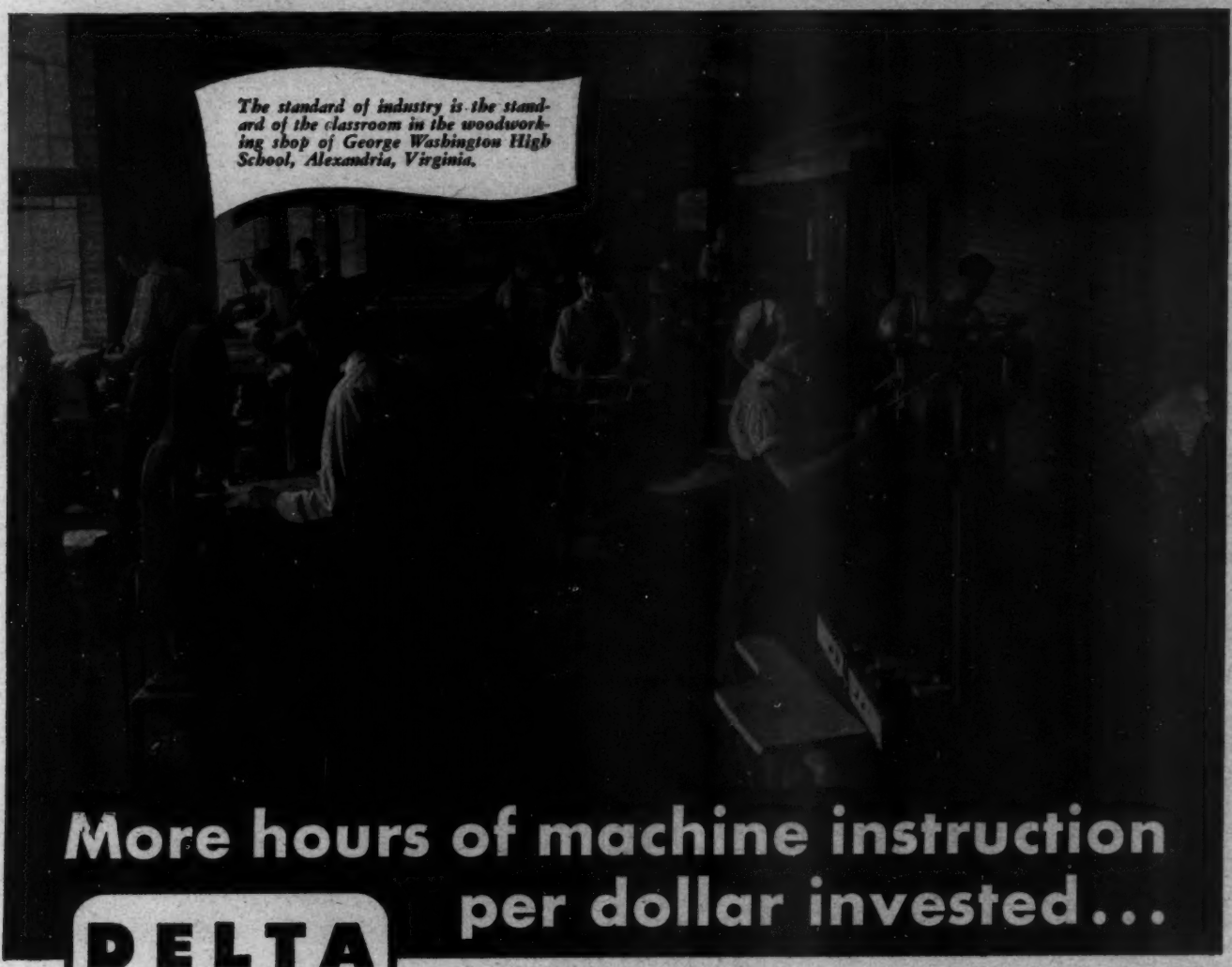
Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."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MARCH 1947

Shop Planning for the Small High School*

SYLVAN A. YAGER
Indiana State Teachers College
Terre Haute, Ind.

FRED J. SCHMIDT, JR.
Ball State Teachers College
Muncie, Ind.

The development of good shop plans and adequate equipment lists requires intense effort and involves considerable research. The two plans submitted in this article are no doubt far from perfect, although they are consistent with the more recent thinking in the field of industrial arts. They should be of much help to the small schools in rural areas.

Hundreds of schools in every section of the country look forward to building programs of some kind. In many cases new buildings will be constructed, while in other cases extensive remodeling will be adequate.

In both cases, however, scores of shops will be involved. Many shops will be enlarged, others will be redesigned, while scores of new shops will be constructed. Each situation requires much checking and planning. Basic philosophy must be reevaluated and determined, community resources must be studied, and definite plans must be developed for present needs with adequate consideration given to future development, growth, and expansion.

Although industrial arts is a part of general education and ties in with the content of many other fields, it does not necessarily follow that an industrial-arts laboratory or a general shop can be adequately housed in a standard-size classroom. The varying nature of the work and the equipment necessary require more space, especially for the safe operation of power machines.

The industrial-arts shop of today must provide for a variety of activities in order that its objective of exploration may be fulfilled. A shop which provides for planning, experimenting, testing, and investigating, naturally requires more space than that provided for a standard classroom.

There are many services which the industrial-arts program can contribute to other subject-content fields in a public school. With this thought in mind and the fact that a greater amount of floor space is required, it can readily be seen that the problems encountered in the planning of an industrial-arts shop become numerous and decidedly complicated.

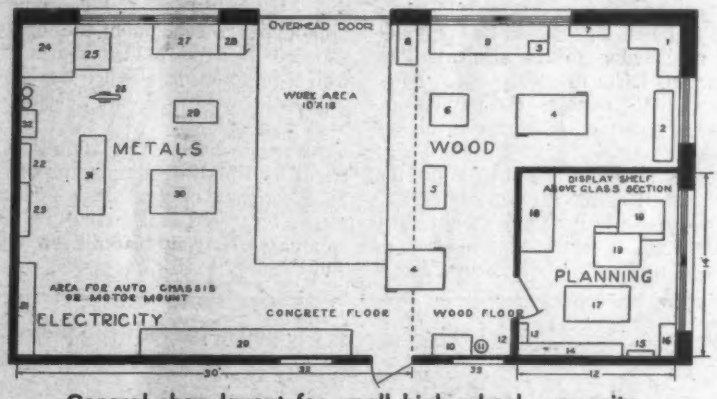
The number of requests for help in both the remodeling of present shops or in the planning of new shops is a clear indication of the need for carefully developed shop plans and equipment lists. It is also quite evident that progress or lack of progress in the industrial-arts field will be, to a very great extent, determined by the type of remodeling of existing plants or the planning of new plants within the immediate future.

The accompanying floor plans represent what is considered a minimum requirement for a good general shop, adequate for the housing of two differently sized groups. Many schools will wish to go considerably beyond this minimum.

Each shop has provisions for drawing and planning, electricity, metals, and wood. Sixteen pupils can be accommodated in the small shop while the larger shop will accommodate 25 pupils.

It should be noticed that the very heart or hub of activity in these shop plans is the open work area. Around this are located the different work centers from which may be drawn equipment and supplies in the development of projects brought into the open work area.

No attempt has been made in this article to discuss many important topics that should be carefully studied before actual construction begins. The industrial-arts teacher and the architect should give consideration to each topic in the following list: type of floor, lighting, ventilation, service facilities, safety factors, shop ar-



General shop layout for small high school — capacity, 16 students. Inside dimensions 25 by 50 ft.

1. Lumber storage; 2. wood lathe; 3. bench grinder; 4. movable woodwork benches; 5. jointer; 6. table saw; 7. tool panel for woodwork tools; 8. jig saw; 9. workbench, lockers below; 10. lavatory; 11. wastepaper basket; 12. bulletin board; 13. magazine rack; 14. bookcase; 15. first-aid cabinet; 16. metal filing cabinet; 17. teacher's desk; 18. worktable; 19. drawing tables; 20. student lockers and supply cabinet; 21. electrical table; 22. tool panel for metalwork tools; 23. vertical metal storage; 24. welding booth; 25. forge; 26. anvil; 27. workbench; 28. bench drill press; 29. grinder; 30. metal area workbench; 31. metal lathe; 32. oxyacetylene welding unit; 33. display case with lights.

*Recognition is hereby given to Mr. Robert K. Moore, a graduate student at Indiana State, who assisted in developing the material in this article. Mr. Moore is now teaching at Winchester, Ind.

rangements, dust collection, noise control, sanitation, relationship of work areas, and the like.

Assuming that administrators and industrial-arts teachers, confronted with the problem of remodeling or building a new industrial-arts shop would welcome help in such an undertaking, a brief philosophy of industrial arts, suggested floor plans, and equipment lists with approximate costs, follow.

Our tremendous industrial development is of great significance in our present complex social order. Every possible effort should be made to interpret this highly industrialized social order to boys and girls. Since boys and girls of all ages as well as adults are members of our social family, it becomes apparent that industrial arts should be a part of the educational program of all school grades and ages as well as that of adults.

Industrial arts is that phase of general education which is concerned with materials, processes, products, and problems of industry and their contributions and significance in relation to our daily living.

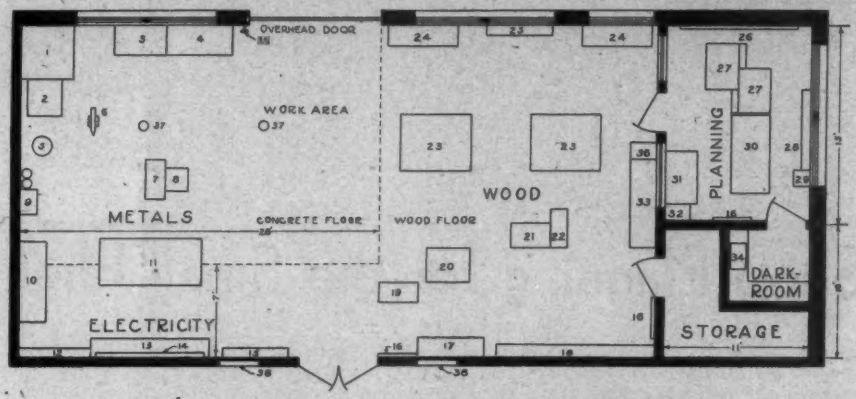
Tools, machines, and materials cannot be used without involving some skill, although the teaching of skills is not as important in industrial arts as it is in vocational education.

The intelligent use of materials involves a wide range of significantly related information that becomes an essential part of every good industrial-arts program.

A good industrial-arts program provides opportunities for the pupils to translate theory into practice in order that the resulting experiences may have fuller meaning and significance. Every project and every activity carried on in the industrial-arts shop or laboratory should be stimulating and challenging to the student. The teacher, in his haste to assist pupils, however, many times removes the pupil's opportunity of solving problems involving pupil thinking.

Industrial arts offers much of value for the development of avocational interests.

An industrial-arts program should start with a child at his own level, and through activities in which he has a natural interest help him raise his standards, broaden his understanding, and increase his ability to achieve. Success is built on interest and interest is the foundation of growth. Being interested in an activity, however, does not always mean achievement. Much planning and direction must be provided.



General shop layout for small high school — capacity, 25 students. Inside dimensions 25 by 60 ft.

1. Welding booth; 2. forge; 3. foundry; 4. sand bin; 5. foundry furnace; 6. anvil; 7. floor grinder; 8. drill press; 9. oxyacetylene welding; 10. metal lathe; 11. metal area workbench; 12. metal rack; 13. electrical table; 14. electrical panel; 15. metal toolboard; 16. bulletin board; 17. lavatory; 18. lumber rack; 19. jointer; 20. table saw; 21. band saw; 22. jig saw; 23. woodwork benches; 24. wood lathes; 25. woodwork toolboard; 26. blackboard; 27. drawing tables; 28. book cupboard; 29. lavatory; 30. planning table; 31. teacher's desk; 32. filing cabinet; 33. finishing and glue table; 34. darkroom lavatory; 35. water spigot; 36. bench grinder; 37. floor drain outlets; 38. display case with lights.

We *learn by doing* is a definite and generally accepted principle in education. No subject makes greater use of this principle than does industrial arts. Too much stress cannot be placed upon the opportunity afforded by the industrial-arts program which provides experience for boys and girls to learn to work and develop efficient work habits.

Although a degree of appreciation may result by simply reading about a material, an experience, or a resulting product, it is generally agreed that lasting appreciations can most effectively be built through actual experiences.

Experimentation with materials, processes, and their applications should be encouraged all through the elementary grades, the junior high school, and the senior high school shop.

The modern industrial-arts shop provides for a broad range of activities. These activities should involve individual and group activity. The type of shop generally accepted as making the most adequate provision for a general education emphasis of industrial-arts content is the general shop.

The shop environment should be pleasant, congenial, and satisfying to pupils as individuals and as groups.

Pupils can assume a large part of the responsibility for routine duties in the operation of the industrial-arts class. Plans of democracy will find a wide range of application in the industrial-arts shop. Training in leadership can be provided and intelligent followers can be developed.

Equipment List for the General Shop

	16 student		*25 student*	
	No. desired	*Cost*	*No. desired*	*Cost*
Woodwork:				
Power equipment:				
Grinder, bench — 1 x 7 in. wheel, shield, plane iron and chisel attachment, 1/3-hp., 3-phase, 220-volt motor	1	$ 66.00	1	$ 66.00
Jointer, 6 in., bed length 37 in., ½-hp., 220-volt motor, pedestal	1	108.00	1	108.00
Lathe, wood — 12 in. swing, 5 ft. bed, ½-hp., 3-phase, 220-volt motor, lathe bench	1	117.00	2	234.00
Saw, band — 16 in. wheel, table 17 x 18 in., ½-hp., 220-volt motor			1	140.00
Saw, jig, 24 x 5 in., 1/3-hp. motor, pedestal	1	78.00	1	78.00
Saw, table — 10 in. dia. saw, table 27 x 36 in., 1-½ hp., 220-volt motor	1	196.00	1	196.00
Equipment (other):				
Bar, wrecking, 24 in.	1	.63	1	.63
Bench dusters, 8 in. horsehair	8	3.04	10	3.80
Bench, glue and finishing, 2 x 8 ft.			1	21.75
Bench, work, 27 in. x 9 ft., with lockers	1	100.00		
Bench, woodwork, 36 x 52 in., with 12 lockers	2	165.00		

	16 student		25 student	
	No. desired	Cost	No. desired	Cost
Bench, woodwork, 54 x 64 in., with 12 lockers			2	190.00
Bit, auger, sizes ¼ to 1 in. by 16ths	1 set	7.50	1 set	7.50
Bit, countersink, ¾-in. cutting edge	1	.33	1	.33
Bit, expansion, capacity ⅞ to 3 in.	1	1.28	1	1.28
Bit, fostner, ¼, ⅜, ½, ¾ in.	1 set	5.89	1	5.89
Bit guage	1	.90	1	.90
Bit, gimlet, ⅛, 3/16, ¼ in.	1 set	.36	1 set	.36
Bit, screw driver, ⅜ in.	1	.20	1	.20
Bit, twist drill, ⅛ to ¼ in. by 32nds	2 sets	1.92	2 sets	1.92
Brace, ratchet bit, 8-in. sweep	1	4.00	1	4.00
Brace, ratchet bit, 10-in. sweep	1	4.00	1	4.00
Caliper, 8-in. outside, screw adjustment	2	3.00	3	4.50
Caliper, 8-in. inside, screw adjustment	2	3.00	3	4.50
Can, oil, ½ pint	2	1.00	3	1.50
Chisel, wood, ¼, ⅜, ½, ¾, 1, and 1½ in.	1 set	5.18	1 set	5.18
Clamp, "I-bar," 3 ft.	4	14.00	6	21.00
Clamp, "I-bar," 5 ft.	3	10.50	4	14.00
Clamp, hand screw, 12-in. jaw	4	7.00	6	10.50
Clamp, hand screw, 10-in. jaw	2	3.00	2	3.00
Clamp, hand screw, 8-in. jaw	2	2.65	2	2.65
Clamp, "C," 6-in. opening	2	2.00	3	3.00
Clamp, "C," 4-in. opening	2	1.60	2	1.60
Clamp, saw	1	2.79	1	2.79
Dividers, 8-in. extension	1	1.60	2	3.20
Drill, hand, ½-in. capacity	1	1.90	1	1.90
Gauge, marking	2	1.10	3	1.65
Hammer, claw, 13 oz.	3	3.51	4	4.68
Hammer, claw, 16 oz.	1	1.17	1	1.17
Knife, 10-in. draw.	1	1.55	1	1.55
Knife, stiff blade putty	1	.35	1	.35
Knife, sloyd	2	.80	3	1.20
Knife, fiber board	2	1.50	2	1.50
Level, 24 in. long	1	2.25	1	2.25
Mallet, wood, barrel-shaped head	2	1.20	3	1.80
Miter box, 4 x 24 in. saw	1	22.88	1	22.88
Nail set, 3/32 and ⅛ in.	1 ea.	.30	1 ea.	.30
Plane, block, 7-in. bed	2	2.88	2	2.88
Plane, jack, 14-in. bed	4	14.00	4	14.00
Rule, 24 in. long, 2 fold, 1½ in. wide	4	2.80	6	4.20
Saw, back, 12 in.	2	4.24	2	2.24
Saw, coping, 8 in.	4	3.20	6	4.80
Saw, hand, cross cut, 22-in. blade, 10 point	2	5.60	3	8.40
Saw, hand, rip cut, 24-in. blade, 7 point	1	3.00	1	3.00
Saw, hand turning, 18-in. blade	1	1.75	1	1.75
Saw set	1	1.50	1	1.50
Scraper, cabinet, size 3 x 4 in.	2	.30	3	.45
Screwdriver, 8 in.	2	1.16	3	1.74
Screwdriver, 6 in.	2	.88	2	.88
Spokeshave, 1¾-in. cutter	1	.31	1	.31
Stone, combination oil, 2 x 7 in., coarse and fine	3	3.75	4	5.00
Stone, slip, for curved inside and outside edges	1	1.25	1	1.25
Square, combination, 12-in. blade	1	1.50	1	1.50
Square, steel, 12 x 18 in.	1	1.65	1	1.65
Square, framing, 16 x 24 in.	1	1.80	2	3.60
Square, try, 6-in. blade	4	3.60	4	3.60
Square, try, 8-in. blade	1	1.10	1	1.10
"T" bevel, 8-in. blade	1	1.05	1	1.05
Wood-turning tools: ¼-in. gouge, ½-in. gouge, 1¼-in. gouge, ¼-in. chisel (skew), 1-in. chisel (skew), ¼-in. round point, ½-in. diamond point, ½-in. parting, (all ⅛ in. thick)	1 set	10.89	2 sets	21.78
TOTAL:		$1,043.27		$1,271.89
Drawing and Planning:				
Board, drawing, 18 x 24 in.	2	$ 3.00	2	$ 3.00
Board, drawing, 16 x 21 in.	4	4.56	6	6.84
Chair	3	29.25	4	39.00
Compass, 6 in.	4	8.00	6	12.00
Desk and chair, teachers', 30 x 42-in. desk top	1	83.00	1	83.00
French curve, No. 15	1	.70	2	1.40
French curve, No. 16	1	.65	2	1.30
French curve, No. 23	1	1.10	2	2.20
Scale, architect, 12-in. boxwood	6	3.30	8	4.40
Set, drawing	2	21.00	3	31.50
Sharpener, pencil, for various size pencils	1	2.00	1	2.00
Stool, drawing, 30 in. high, metal legs	4	20.00	4	20.00
Square, "T," hardwood, 24-in. blade	2	2.40	2	2.40
Square, "T," hardwood, 21-in. blade	4	4.40	6	6.60
Table, drawing, 30 x 42 in., drop leaf 6 x 21 in., 2 students per table	2	100.00	2	100.00
Table, planning, 30 in. x 6 ft.	1	42.00		
Table, planning, 36 in. x 6 ft.			1	45.00
Triangle, 30–60 deg., amber, 10 in.	4	1.12	6	1.68
Triangle, 45 deg., amber, 8 in.	4	1.12	6	1.68
TOTAL:		$ 327.60		$ 364.00
Machine Shop:				
Power equipment:				
Drill press, floor, 14 in., No. 1 Morse spindle, ½-hp., 220-volt motor			1	$ 125.00
Drill press, bench, 14 in., No. 1 Morse spindle, ½-hp., 220-volt motor	1	116.00		
Grinder, pedestal model — eye shield, tool rest, water pot, ½-hp., 220-volt motor	1	99.00	1	99.00
Lathe, metal — 13-in. swing, 5-ft. bed, quick change gears, underneath-motor drive, with accessories	1	1,200.00	1	1,200.00
Equipment (other):				
Awl, scratch	2	.70	3	1.05
Bench, work, 27 in. x 7 ft.	1	17.50		
Bench, work, 42 x 92 in., combination machinist and sheet-metal bench, 3 storage shelves			1	150.00
Bench, work, 40 x 60 in., combination machinist and sheet-metal bench, 3 storage shelves	1	91.00		
Brush, bench	3	1.15	3	1.15
Caliper, spring, inside 6 in.	2	1.60	2	1.60
Caliper, spring, outside 8 in.	2	1.60	2	1.60
Can, oil, ½ pint	3	1.50	4	2.00
Can, waste, 12-in. dia.	1	2.00	1	2.00
Chisel, cold, ½ and ¾ in.	2 ea.	1.25	2 ea.	1.25
Clamp, "C," 6 in.	2	2.00	3	3.00
Clamp, "C," 8 in.	2	3.00	3	4.50
Clamp, parallel, 4-in. jaw	2	3.00	3	4.50
Divider, 6 in.	2	2.10	3	3.15
Drill, electric, ½-in. capacity	1	53.00	1	53.00
Dresser, emery wheel, No. 0	1	.68	1	.68
Drill, high-speed steel, straight shank, set ⅛ to ½ in. by 64ths	1 set	33.90	1 set	33.90
Drill, high-speed steel, taper shank, ½ to 1 in. by 32nds	1 set	48.32	1 set	48.32
Drill, high-speed, combination countersink, body dia. 7/16 in., drill dia. 3/16 in.	1	1.00	1	1.00
Drill, center reamer, high-speed steel, ¼ in.	1	1.90	2	3.80
Frame, hack saw, 10-in. adjustable	2	1.20	2	1.20
Gauge, center	1	.50	1	.50
Gauge, screw pitch	1	1.25	1	1.25
Gauge, surface, 3½-in. base	1	4.00	1	4.00
Gauge, tap and drill	1	2.40	1	2.40
Gauge, thickness	1	1.50	1	1.50
Goggles, safety	3	4.86	4	6.48
Hammer, ball-peen, 12-oz.	2	1.50	2	1.50
Hammer, ball-peen, 16-oz.	2	1.60	2	1.60
Hammer, riveting, 12-oz.	1	1.08	1	1.08
Jig, bending	1	2.75	1	2.75
Mallet, rawhide, 1½ x 3½ in.	1	.75	1	.75
Micrometer, 0–1 in. with ratchet stop, decimal equivalents	1	10.00	1	10.00
Micrometer, 1–2 in. with ratchet stop	1	9.00	1	9.00
Pliers, combination, 6 in.	2	.42	3	.63
Pliers, combination, 8 in.	1	.35	1	.35
Punch, solid, 3/32, ⅜, and 5/32 in.	1 ea.	.37	1 ea.	.37

	16 student		25 student	
	No. desired	Cost	No. desired	Cost
Punch, center, 5 in.	2	.44	2	.44
Reamer, ¼ to 1 in. by 16ths	1 set	23.00	1 set	23.00
Scale, machinist, spring-tempered steel, 6 in. by 64ths	2	3.70	4	7.40
Scale, machinist, spring-tempered steel, 12 in. by 64ths	1	4.00	1	4.00
Screw plate set, with taps and dies, sizes ¼, 5/16, ⅜, and 7/16 in., ½, and ⅝ in., 2 stock and 1 tap wrench, U.S.S. thread	1 set	18.00	1 set	18.00
Square, combination, 12 in., with center head	1	6.20	1	6.20
Square, try, steel, 4-in. blade	1	1.50	1	1.50
Vise, machinist, 3½-in. jaw	3	27.00	4	36.00
Wrench, monkey, 10 in.	1	1.39	1	1.39
Wrench, crescent, 8 in.	1	1.00	1	1.00
Wrench, crescent, 10 in.	1	1.35	1	1.35
Wrench, socket, 10 sockets, 7/16 to 1 in., with 12 point openings, 1 handle	1 set	14.70	1 set	14.70
TOTAL:		$1,828.01		$1,900.84
Welding:				
Electric welding:				
Arc welder, a.c. 20 to 275 amp., 220-volt, 60 cycle, with 2 power-line-to-welder cables, 2 cables from welder to welding table, 1 electrode holder	1	$ 235.00	1	$ 235.00
Booth, welding, 4 x 4 ft. (to be made)	1		1	
Chipper and brush, combination	1	1.65	1	1.65
Gloves, leather	1 pr.	2.50	1 pr.	2.50
Helmet, welding	2	14.00	2	14.00
Pliers, combination, 8 in.	1	.35	1	.35
Shield, hand	2	7.00	2	7.00
Oxyacetylene welding:				
Cart, portable welding	1	18.00	1	18.00
Clamp, "C," 8 in.	2	3.00	2	3.00
Cylinder of acetylene (on loan basis)	2		2	
Cylinder of oxygen (on loan basis)	2		2	
Goggles, welding	2	4.90	2	4.90
Lighter, spark	1	.25	1	.25
Pliers, combination, 8 in.	1	.35	1	.35
Table, welding, 15 x 24 in. (to be made)	1		1	
Torch, cutting	1	21.00	1	21.00
Torch, welding, complete with regulators, hose, assorted tips, wrenches	1 set	84.00	1 set	84.00
TOTAL:		$ 392.00		$ 392.00
Sheetmetal:				
Awl, scratch	2	.70	2	.70
Bar folder, 30-in. adjustable	1	98.00	1	98.00
Dividers, 8-in., with lock nut	1	.98	1	.98
Dividers, 10-in., with lock nut	1	1.53	1	1.53
Former, slip roll, capacity 36-in. sheet	1	62.00	1	62.00
Hammer, riveting, 9 oz.	1	1.00	1	1.00
Hammer, tinners setting, 12 oz.	2	2.20	2	2.20
Iron, electric soldering, ½-in. tip	1	7.00	1	7.00
Iron, electric soldering, ⅞-in. tip	1	9.00	1	9.00
Mallet, tinners', 3 x 6 in., hardwood	2	1.00	2	1.00
Punch, center, ⅛ x 4¼ in.	2	.50	2	.50
Punch, hollow, ⅛, ½, and ¾ in.	1 ea.	3.00	1 ea.	3.00
Punch, solid, ⅛, 5/32, and 3/16 in.	1 ea.	.37	1 ea.	.37
Rotary machine, combination, 4 sets of rollers for crimping, turning, burring, and wiring; stand to hold machine	1	58.00	1	58.00
Rule, metal, 18 in., graduated in 64ths	1	2.60	1	2.60
Rule, metal, 24 in., graduated in 64ths	1	3.25	1	3.25
Rule, metal, 36 in., graduated in 64ths	1	3.90	1	3.90
Snips, tin, 3-in. jaw	1	2.50	1	2.50
Snips, tin, curved blade, 3-in. jaw	1	3.75	1	3.75
Stake holder, 8 x 30 in.	1	9.00	1	9.00
Stake, beakhorn, flat end tapers 2 to 1½ in., round end tapers 2 to ⅝ in.	1	28.00	1	28.00
Stake, blowhorn, dia. small end 1½ in., tapers to ⅜ in. dia. large end 4¾ in., tapers to ⅜ in.	1	16.00	1	16.00
Stake, bottom, length 13½ in., face 1⅛ in.	1	6.00	1	6.00
Stake, creasing, grooved for Nos. 2, 3, 6, 7, 8, and 9 wire, length 18 in.	1	15.00	1	15.00
Stake, double seaming, ends 3 x 1¾ in., length 29 in.	1	26.00	1	26.00
Stake, hollow mandrel, length 40 in., flat part 6 x 9 in.	1	18.00	1	18.00
Stake, round head, 3-in. head dia.	1	12.00	1	12.00
Stake, square, 2¾ x 4½ in.	1	9.25	1	9.25
TOTAL:		$ 400.53		$ 400.53
Forging:				
Anvil, 100 lb., steel face and horn	1	13.80	1	13.80
Anvil base, wood, elm stump 16 x 16 x 24 in.	1	5.00	1	5.00
Anvil hardie, 1-in. shank	1	1.00	1	1.00
Chisel, hot, 1½-in., with 16-in. handle	1	1.77	1	1.77
Forge, steel, hearth 24 x 24 in., electric blower	1	68.00	1	68.00
Fuller, bottom, ½-in., with 16-in. handle	1	1.40	1	1.40
Fuller, top, ½-in., with 16-in. handle	1	1.40	1	1.40
Hammer, ball-peen, 24 oz.	1	.89	1	.89
Hammer, straight-peen, 24 oz.	1	.89	1	.89
Hammer, sledge, 8 lb., with 32-in. handle	1	2.20	1	2.20
Tongs, curved lip, hold rounds, ⅜, ½, and ¾ in.	1 ea.	4.50	1 ea.	4.50
Tongs, gad, general purpose, length 16 in.	1	1.60	1	1.60
Tongs, flat lip, length 16 in.	2	2.00	2	2.00
Swage, bottom, ½-in., with 16-in. handle	1	1.75	1	1.75
Swage, top, ½-in., with 16-in. handle	1	1.75	1	1.75
TOTAL:		$ 107.95		$ 107.95
Electricity:				
Battery, auto, 6 volt	1	9.00	1	9.00
Bench, electrical work, 18 in. x 9 ft.			1	22.00
Bench, electrical work, 20 in. x 7 ft.	1	20.00		
Burglar alarm, closed circuit	1	.80	1	.80
Burglar alarm, open circuit	1	.42	1	.42
Compass, magnetic	1	1.00	1	1.00
Connector box	12	.72	18	1.08
Connector plug	2	.16	3	.24
Cube taps	2	.16	3	.24
Door bell	2	.84	3	1.26
Door bell transformer, primary 110–120, secondary 10 volts	1	.90	1	.90
Door buzzer	2	.72	3	1.08
Dry cells, 1½ volts	6	2.10	9	3.15
Iron electric soldering, ½-in. tip	1	7.00	1	7.00
Outlet box, octagon, No. 3¼	4	.40	6	.60
Panel, electric, 6 in. x 8 ft. (to be made)			1	
Panel, electric, 6 in. x 7 ft. (to be made)	1			
Pliers, combination, 6 in.	2	.42	3	.63
Pliers, combination, 8 in.	1	.35	1	.35
Pliers, electricians	2	3.50	3	5.25
Motor-generator set (old auto generator, motor, ¼ hp., 110 volt	1	16.00	1	16.00
Receptacle, duplex	2	.20	3	.30
Receptacle and pilot light	1	.55	1	.55
Receptacle, porcelain cleat	4	.28	6	.42
Screwdriver, electricians, 6 in.	3	1.20	4	1.60
Socket, keyless	2	.30	3	.45
Socket, push thru	2	.30	3	.45
Socket, twin light	1	.15	1	.15
Switch, battery, double pole, double throw	1	.30	1	.30
Switch, double pole, fused	1	.50	2	1.00
Switch, flush toggle	2	.24	3	.36
Switch, key socket	2	.30	3	.45

	16 student		25 student	
	No. desired	Cost	No. desired	Cost
Switch, single-pole snap	1	.30	1	.30
Switch, single-pole toggle	1	.15	1	.15
Switch, three-way, flush	1	.15	1	.15
Switch box, single gang loom	2	.30	3	.45
Vise, machinist, 3-in. jaw	2	16.00	3	24.00
Voltmeter, range 50 volts, 40 amp.	1	1.25	1	1.25
TOTAL:		$ 86.96		$ 103.33
Foundry:				
Bulb sponge, 4-oz. capacity			2	3.00
Crucible, graphite, No. 9			1	3.50
Crucible furnace, complete with lid, derrick for lifting lid, and blower			1	100.00
Crucible tongs, 17 in.			1	2.00
Cutter, spruce, ¾ x 10 in.			2	1.00
Flask, 14 x 14 in., aluminum alloy			2	18.00
Flask, 12 x 12 in., aluminum alloy			4	32.00
Molders bellows			1	2.60
Molders tool, lifter, width ⅛ in.			2	1.40
Molders tool, slick and square, width ¾ in.			2	1.50
Molders tool, spoon and gate cutter, width 1 in.			2	1.50
Molders tool, trowel, 1¼ x 6 in.			2	2.00
Molding board, 12 x 12 in. (to be made)			8	
Molding board, 14 x 14 in. (to be made)			4	
Rammer, bench, 3½ x 14 in., hardwood			2	1.50
Riddle, foundry, 18-in. dia., 16 mesh to 1 in.			1	1.00
Riddle, foundry, 18-in. dia., 8 mesh to 1 in.			1	1.00
Sand, albany molding, 125-lb. bags			3 bags	11.25
Shovel, square point, size 2, blade 10 x 12 in.			1	1.50
TOTAL:				$ 184.75
Concrete:				
Bucket, galvanized, 2½ gallon			3	3.00
Drill, star, ¾ x 12 in.			1	.45
Edger, 2¾ x 6 in., ⅜-in. radius			1	.50
Edger, bevel, 2¾ x 6 in.			1	.50
Float, wood, 4 x 11 in.			3	1.65
Groover, 3 x 6 in.			1	.50
Shovel, square point, size 2			2	3.00
Tamper, iron, base 6 x 6 in., weight 10 lbs.			1	1.20
Trowel, cement, 10 in.			2	4.50
Trowel, pointed, 4 in.			2	1.00
TOTAL:				$ 16.30
Totals:				
Woodwork		$1,043.27		$1,271.89
Drawing and Planning		327.60		364.00
Machine Shop		1,828.01		1,900.84
Welding		392.00		392.00
Sheet Metal		400.53		400.53
Forging		107.95		107.95
Electricity		86.96		103.33
Foundry				184.75
Concrete				16.30
GRAND TOTAL:		$4,186.32		$4,741.59

It is recommended that the following items be built in when the shop is constructed:

Bin, sand (for concrete work)		1
Bin, sand (for foundry work)		1
Lumber rack, 20 in. x 7½ ft.	1	
Metal storage rack, 10 in. x 5½ ft.		1
Metal storage rack, 10 in. x 4 ft.	1	
Tool panel, 10 in. x 3 ft. (for woodwork tools)	1	
Tool panel, 10 in. x 5 ft. (for woodwork tools)		1
Tool panel, 10 in. x 3 ft. (for metalwork tools)	1	
Tool panel, 10 in. x 5 ft. (for metalwork tools)		1

BIBLIOGRAPHY

Allen, Charles, S., "Traip Academy General Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 29, pp. 94–95, March, 1940.

Bawden, Wm. T., "Organization in the School Shop," *Industrial Education* magazine, Vol. 36, pp. 93–95, March 1934.

Bedell, Earl L., "The General Shop Idea," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 21, pp., 205–210, July, 1932.

Bollinger, Elroy W., "Principles of Industrial Arts Equipment Selection," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 31, pp. 128–130, March, 1942.

Chamberlain, Duane, "Floor Areas and Equipment in Small High School Shops," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 31, pp. 130–131, March, 1942.

Dell, S. M., "The Frantz Industrial Arts Building," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 33, pp. 87–88, March, 1944.

Educational Press Association, "Modern General Shop Plans," *School Shop*, Vol. 5, pp. 15–19, June, 1946.

Finsterbach, F. C., "Industrial Arts Equipment List — Comprehensive General Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 35, pp. 204–211, May, 1946.

Hackell, Douglass, "Planning the General School Shop," *School Shop*, Vol. 5, pp. 12–14, June, 1946.

Hill, A. P., Jr., "Space and Equipment for Shop and Laboratory," *School Executive*, Vol. 65, pp. 42–43, July, 1946.

Hunter, William L., "Industrial Arts Laboratory Planning — 1," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 27, pp. 101–104, March, 1938; pp. 137–139, April, 1938; pp. 182–184, May, 1938.

"Industrial Arts in Rural Schools" (illus. plan), *Nation's Schools*, Vol. 30, p. 34, Sept., 1942.

Johnson, William F., "Industrial Arts in a Small School," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 33, pp. 88–89, March, 1944.

Jones, E. W., "Electricity in the General Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 28, pp. 98–100, March, 1939.

Karnes, Roy, "An Industrial Arts Experimental Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 30, pp. 101–102, March, 1941.

Ketcham, Wesley G., "An Industrial Arts Expansion Program," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 35, pp. 109–115, March, 1946.

Komow, Maximillian, "The Planning of Vocational Departments in High School," *American School Board Journal*, Vol. 108, pp. 25–27, January, 1944.

Mann, George J., "The General Shop at Haldane Central School," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 29, pp. 89–91, March, 1940.

Miller, C. F., "Planning the Arts Department in the Secondary School," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 31, pp. 238–239, June, 1942.

Nihiser, Edwin E., "New General Industrial Arts Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 31, pp. 126–128, March, 1942.

Paine, H. W., "Designing Industrial Arts and Vocational Education Shops and Classrooms," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 35, pp. 163–164, April, 1946.

Quinn, H., "Color Is Important in the School Shop," *School Management Magazine*, Vol. 15, p. 19, June, 1946.

Roehl, Louis M., "A Rural High School Shop and Classroom," *American School Board Journal*, Vol. 102, pp. 52–53, January, 1941.

Roehl, Louis H., *Shop Management in Rural Schools*, Bruce Pub. Co., 1935.

Roehl, Louis M., "Workshop in a Rural High School Building," *American School Board Journal*, Vol. 102, pp. 40–41, April, 1941.

Rose, Homer C., "Industrial Arts at Augusta, Wisconsin," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 26, pp. 80–83, March, 1939.

Scantlin, Roy, "Shop Planning and Equipment," Chap. 4, *Industrial Arts Handbook* (for state of Missouri), Bulletin 7B, pp. 87–93, rev. 1945.

"Shops and Laboratories," *School Executive*, Vol. 65, pp. 41–54, July, 1946.

Silvius, G. H., and Johnson, J. J., "Tool Storage: A Place for Everything and Everything in Its Place," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 33, pp. 274–278, September, 1944.

Smith, Fred M., "A Condensed Check List for Shop Planning," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 29, pp. 87–88, March, 1940.

Steinhoff, Lester G., "Storing Woodworking Project Material," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 32, pp. 125–127, March, 1943.

Trella, Frank W., "A Revised Industrial Arts Program," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 35, pp. 106–108, March, 1946.

Warner, Wm. E., "Establishing the General Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 19, pp. 287–290, 344–346, 374–376, 420–425; August, 1930; September, 1930; October, 1930; November, 1930.

Warner, Wm. E., "Studies in School Shop Planning," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 23, pp. 31–38, February, 1934.

Weaver, Roger J., "Initial Steps in Planning Shops," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 30, pp. 238–240, June, 1941.

Winter, Wesley P., "Industrial Arts at Connecticut's First Regional High School," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 31, pp. 131–135, March, 1942.

A Plan for the Small General Shop

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Fig. 1. Low cost modern school planning. Divisions of high school are housed in separate units. Building on right accommodates industrial arts and music

In 1940 the school board of the independent school district surrounding the Agricultural and Mechanical College of Texas campus decided to build an entire new educational plant. The general architectural planning for the school was carried out by the members of the staff and the students of the architecture department of the college. It was an over-all project for advanced students in low-cost school construction. This department has been recognized nationally for planning low-cost school buildings and houses.

Operating on a minimum budget, a series of one-story structures was completed which housed the grades, junior high school, and senior high school. See Figure 1. It seems to be a general practice to place departments which make more than the normal amount of noise together, thus it may be noticed from the general layout that the music room is adjacent to the industrial-arts shop or laboratory, and these two departments comprise one separate building unit.

The various units are at least forty yards apart with covered connecting walks to provide protection during inclement weather and afford an opportunity to enjoy fresh air between classes. This particular feature is somewhat standard for schools in southern states. See Figure 2.

Planning of the departmental rooms and shops was the result of extensive studies by members of the faculty and the students in the departments affected. The floor layout shown on these pages illustrates the composite thinking of students and members of the faculty in the department of industrial education of the A. & M. College of Texas. The general floor space was the maximum which could be alloted with the funds available. Certain pieces of equipment were carried over from the former shop and a small amount of money was added for the purchase of a few new pieces.

Laboratory or Shop Area

Shop plans are as numerous as designers and the existing shops. It would be extremely difficult to establish ironclad rules and regulations which must be observed in all types of shop and laboratory situations. Most state departments of education attempt to specify minimum floor space areas and frequently they establish minimum specifications for tools and equipment, course content, floor space per pupil, and teacher requirements before affiliation may be granted for specific courses. The general rule, however, seems to be that the minimum work area should not be less than approximately 1200 sq. ft. of floor space. The total floor area per pupil activity of the various courses administered in this shop is 1280 sq. ft. This means that the shop or laboratory area would measure about 30 by 40 ft.

For most general minimum situations, this is an ample allowance for small classes, provided there are additional areas set aside for the storage of projects and materials and for finishing.

The types of power equipment also present factors in determining the size of the student working area.

Each floor plan suggested in a mazagine or bulletin always brings to light one or two unusual desirable features which can be applied to most similar plans. The one referred to on these pages is presently being used for a comprehensive general shop or laboratory of industries in a consolidated school district where pupils come from both town and rural areas. Unit shop courses are also offered with the same floor plan arrangement shown in Figure 3.

Much of the effectiveness of instruction with minimum equipment is accomplished by Mr. Les Richardson, the instructor and critic teacher from the College Department of Industrial Education.

Storage

It seems an impossibility to have adequate storage for the shop or laboratory. Even after careful planning there is a tendency to reduce storage space to make room for more work stations. Project storage has been accounted for in this school plan by having a separate compartment for each of the four classes which meet in the shop. This is not always satisfactory for all projects, but it will accommodate at least 90 per cent of them. Each area may be locked by the instructor at the conclusion of the period which prevents the

Fig. 2. Covered walk connects various school units to protect pupils during inclement weather. This is an ideal arrangement in southern states

possible disappearance of partially completed project materials.

Materials and supplies such as art metal, plastics, leather, special hardware, and screws are centered in one main area. This closet is also kept locked by the instructor to prevent pilfering, and to enable him to keep an accurate accounting of supplies.

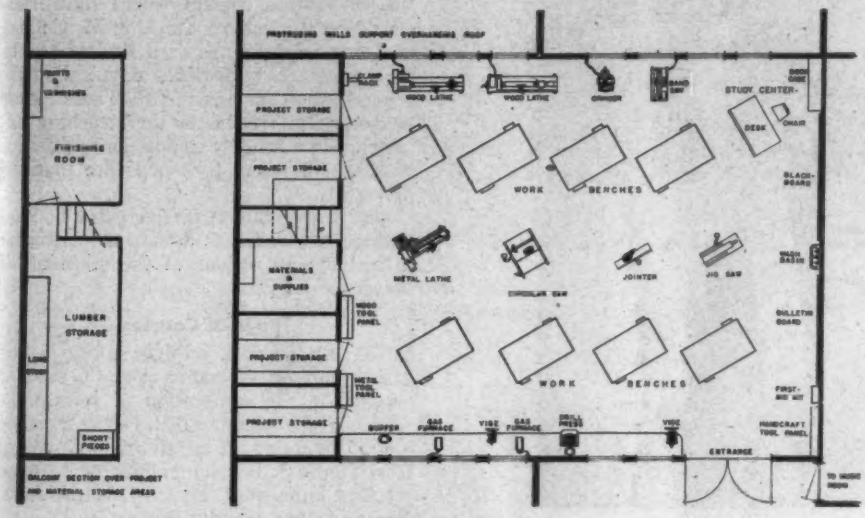


Fig. 3. Layout for a small general shop

In the event that the teacher of this shop preferred to use a tool room, he could adapt this room for such purpose.

The entire series of project and material compartments has 340 sq. ft. of floor space with a 7-ft. ceiling, over which may be found the small finishing room and lumber storage section as indicated in Figure 3. The area above the storage rooms is not ideal for finishing or for lumber storage, but it is a typical example of utilizing available space. The finishing room of 120 sq. ft. of floor space is enclosed on two sides with glass and has a small exhaust fan to eliminate possible fumes. The glass walls permit the instructor to view the activity within this room. The lighting for the finishing room is furnished by both natural and artificial means.

The lumber room of 180 sq. ft. of floor space is enclosed on the front edge by a bannister or railing so that long pieces of lumber may be handed over into the shop. This is convenient because sizable pieces of lumber could not be taken down the stairway. A small section is also provided for the storage of mild steel used in ornamental ironwork, and for large pieces of sheet metal.

The method of keeping tools for student use is by means of wall panel tool cabinets which open up as indicated in Figure 4. The floor plan shows three such panels which care for wood, metal, and handcraft tools. The feature of this method of storage is that all popular tools are displayed for easy vision and accessibility by students. The backgrounds are silhouetted with a contrasting color of paint; this permits the student to return the tool to its proper place and enables the instructor and student foreman to check the tools at the conclusion of each class. The virtue of this type of cabinet is that it may be closed and locked at the end of each day.

Equipment Arrangement

Practically all of the pieces of equipment and benches are arranged at an angle to obtain the maximum natural lighting and to permit ease of operation without interference with fellow students. The work benches are special shop constructed with wood tops, standard wookworking vises, and tubular metal leg construction.

A bench is fastened to one wall which accommodates the various small, portable pieces of bench-type equipment. Sufficient electrical wall outlet receptacles are provided so that equipment may be moved about.

One corner of the room is equipped as a study center. This provides a desk, several chairs, and a small school shop library. Special emphasis is given in this center to the use of inexpensive bulletins, wall charts, and industrial displays. Sources of these materials recently appeared in a series of articles in the INDUSTRIAL ARTS and VOCATIONAL EDUCATION magazine. A revision of this material is to begin in this same magazine within the near future. Much supplementary teaching material of this nature has made teaching a pleasure in this small, low-cost industrial-arts general shop.

A blackboard and bulletin board are located on either side of the wash basin or lavatory. These boards permit the shop teacher to conduct related lessons visually. The bulletin board makes an excellent place to display teaching materials, safety posters, and special announcements.

The wash basin is located conveniently near the exit so students may wash their hands before leaving the shop.

In the event of an injury the pupils and teacher have ready access to a first-aid kit.

Color Scheme

Innumerable excellent articles have been published in the professional magazines, some with fine illustrations, which portray unique arrangements of equipment and specifications for illumination, ventilation, and color schemes. The latter has been emphasized recently through color advertisements which designate new special color combinations for equipment, furnishings, walls, and ceilings. By following the specifications on colors, it is possible to dispense

Fig. 4. Two boys starting in divisions of machine lathe turning and sheet metal. Critic teacher, Les Richardson, gives starting instructions to beginner. Note folding type tool panels in background

with the drab grays and blacks which previously dominated shop colors. The new color scheme is of prominent concern not only because of its effect on eye strain, but also on the psychologically favorable response from students who react with pride to beautiful colors. This pride carries over into shop and class activities.

Fig. 5. Students at work in ornamental iron, bench wood, and in wood lathe turning

Most of the modern school shops and laboratories are being repainted in accordance with the latest results obtained from advanced experimentation by competent authorities. This is especially true where the schools have acquired additional equipment through the various governmental agencies which dispose of surplus equipment. Most of it needs repainting, hence it is as easy to beautify the shop as to leave it drab and unattractive.

Illumination and Ventilation

The modern, improved shop with the new color scheme will probably amplify illumination considerably, due to the effect given by the colors. The floor plan in Figure 3 illustrates an area which has excellent natural illumination from two exposures. It may be seen in Figure 1 that wide, tall windows were inserted into the walls wherever feasible. It is seldom necessary to use artificial lighting in this particular shop, except when cloudy days occur.

Several years ago an interesting series of articles appeared in this magazine on shop planning and illumination. Numerous theses have been written on similar topics. It is wise to have a consultant from the local light and power company check the different shop areas to determine if the correct lighting is used. One of the most common causes of headaches, accidents, and strained vision is inadequate lighting. It is, therefore, of vital importance that industrial teachers observe the factors of adequate lighting in shop planning so students can be freed from factors which cause poor health, accidents, and nervous strain. The student who has the benefit of intelligently planned illumination also acquires an appreciation of industrial practices.

Most shop teachers do not have the control of ventilating their own shop more than what is afforded by window space. The teacher who has a shop or laboratory area with windows on opposite sides similar to the one described in these pages is indeed fortunate. This permits cross ventilation which is naturally conducive to better work and study conditions. It is possible that schools of the future will be planned to make use of air conditioning; but today this possibility is rather remote.

Student-Teaching Center

The shop described in this article is one of several centers where industrial-education students of the A. & M. College of Texas receive supervised student teaching experience. It provides a typical small, general shop arrangement. These same students also receive another teaching experience in a near-by city junior and senior high school where the shops are planned differently.

One of the student teachers may be seen in Figure 6 where he directs the activities in leatherwork as one of the divisions of the general shop.

Types of Courses

The 1280 sq. ft. of floor space in the main shop or laboratory permit student activity in the exploration of several divisions which include wood, Figure 5; sheet metal, Figure 4; art metal, and ornamental iron, Figure 5; bench metal including some machine lathe work, Figure 4; leathercraft, Figure 6; and plastics, Figure 7.

Practically all of the pupils also have a course in planning and drawing in another room. They have access to the facilities of this room for planning and making the necessary working drawings of their projects.

The illustrations accompanying this brief discussion picture pupil interest in the many activities and show the enthusiasm exhibited by youth in the generalized industrial-arts program.

These various divisions or areas are not conducted on a set periodic rotation; however, the instructor expects each pupil to

Fig. 6. Leathercrafters enjoy making projects and learning of industrial possibilities in this activity

Fig. 7. Working with plastics affords new opportunities to boys of junior and senior high school ages

spend approximately four to six weeks in each of the activities. But where it is clearly demonstrated by the pupil that he dislikes one activity, it is permissable for him to remain for a longer period of time in one he likes better. This type of program is conducted for two school years. If the student then wishes to continue industrial arts he may take another year of general woodworking. As soon as possible the equipment in this shop will be supplemented and rearranged to permit a student to take a year of general metalwork also.

It is planned to expand the offering so that a portable tool panel may be taken to the elementary buildings where the children may be given handcraft from the third grade on.

All of the courses offered in this low-cost, typical shop are affiliated with the Texas State Department of Public Instruction.

POOR TEACHER

LEONARD E. SCHMIDT
Lincolndale, N. Y.

Another new term, and a new crop of boys,
Lesson One all over again;
The same hopes and fears, despite all the years,
That you had on that first day — remember back when?

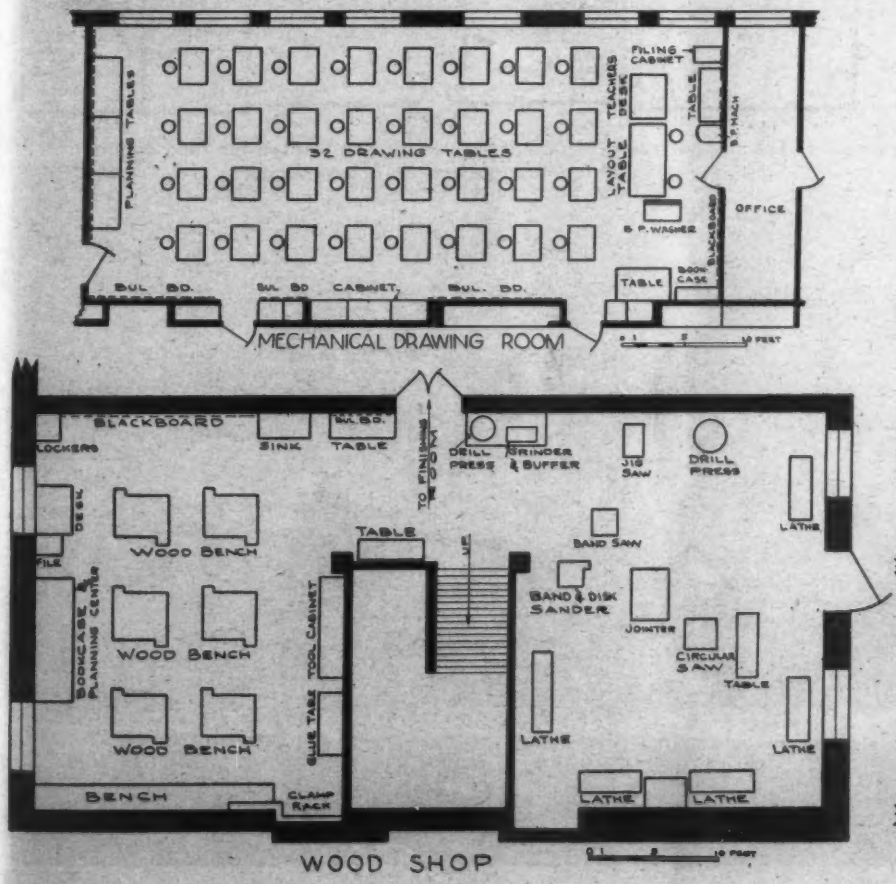
You look them all over, they seem so alert,
They always are on the first day:
And you wonder which ones will rise to the top,
And which ones will fall by the way.

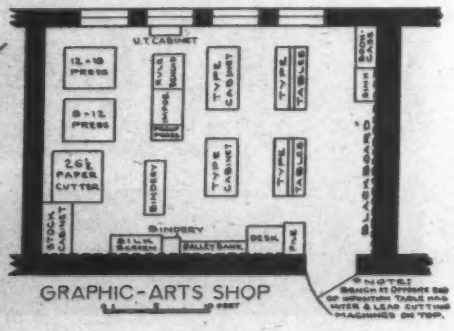
Then you think of last term, and the one before that,
And the boys you were sure would succeed,
How badly you erred, how poorly they fared,
A crystal ball is what you need.

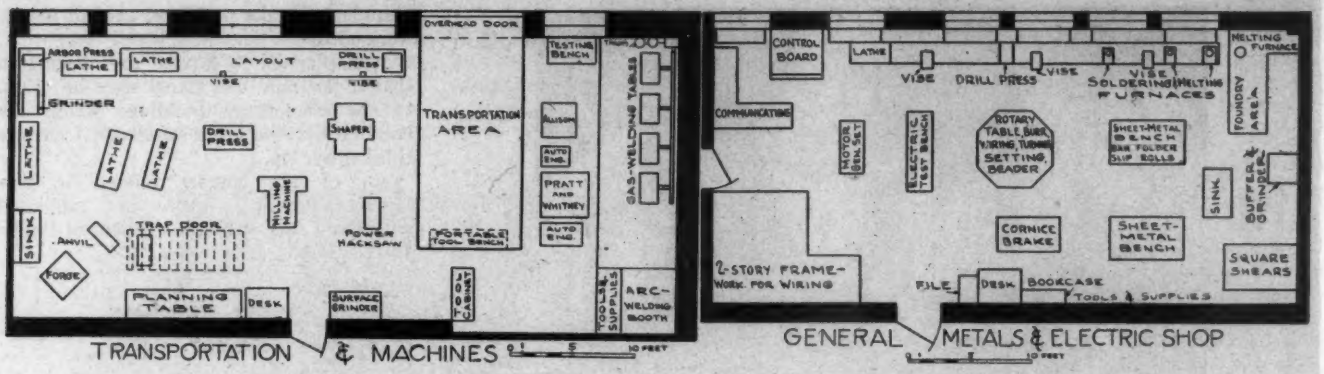
But despite your poor guesses, you do it again,
And pick out Joe, Jimmy, and Ned,
Which all goes to prove that we teachers must be
Just a little bit soft in the head.

Shop Layouts

G. WESLEY KETCHAM
State Supervisor of Industrial Education
Hartford, Conn.



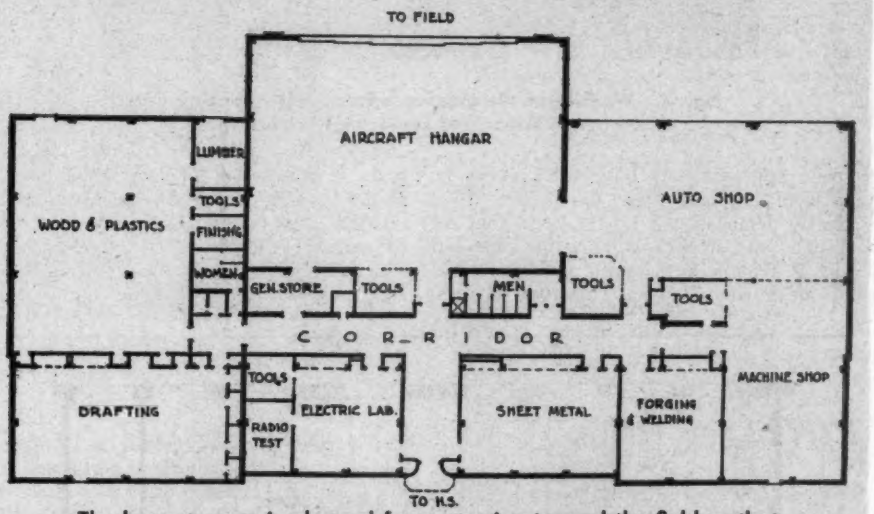




High School Shop Layout

CARLIN ADEN
Director of Adult Education
Clover Park Schools
Pierce County, Washington

The layout shown herewith was designed to give technical and vocational education to high school students. In addition to this it served to train war production workers and is now providing training for the returned G.I.s.



The hangar room is planned for expansion toward the field so that additional planes can be accommodated

General view of the Clover Park shop building as seen from the landing field

Efficient Graphic-Arts Departments

JOHN A. BACKUS
Manager, Education Department
American Type Founders, Elizabeth, N. J.

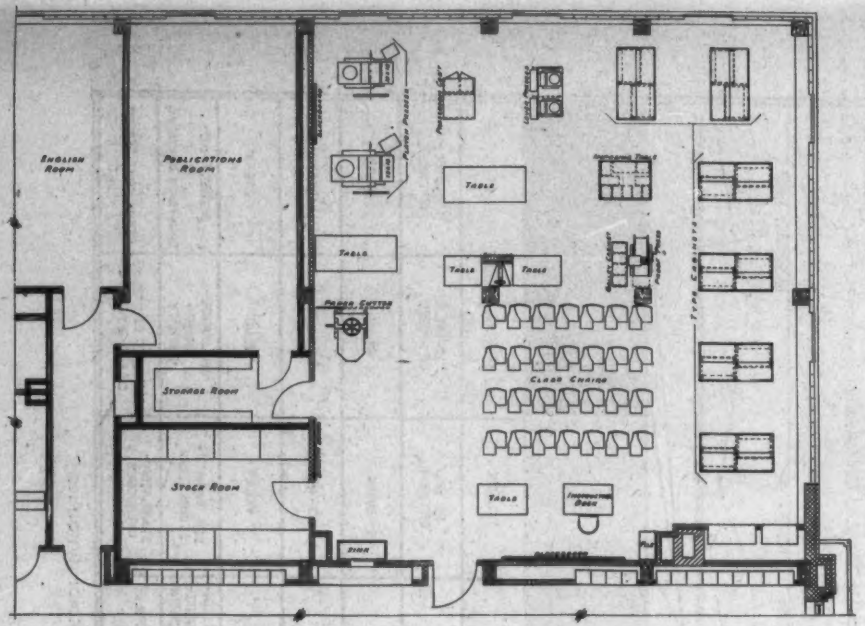


Fig. 1. Plan for a 25–30 pupil graphic-arts department for a senior high school showing correct application of safety, natural lighting, and efficient routing of work

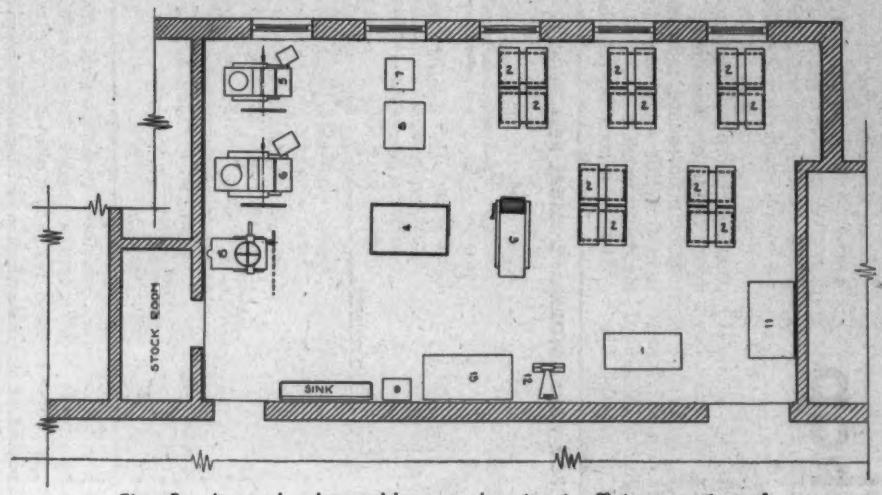


Fig. 3. A poorly planned layout, showing inefficient routing of work and bad lighting arrangement

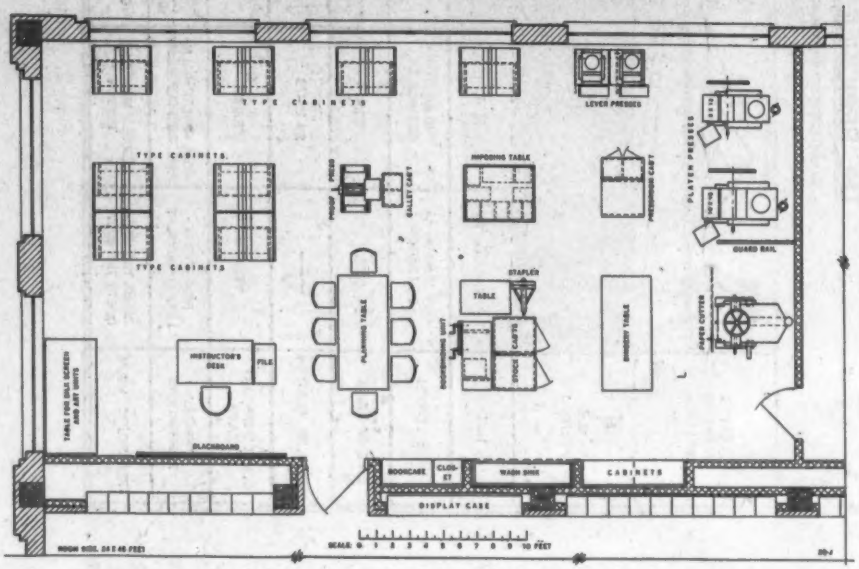


Fig. 2. Arrangement of a 20–25 pupil graphic-arts unit in a junior high school

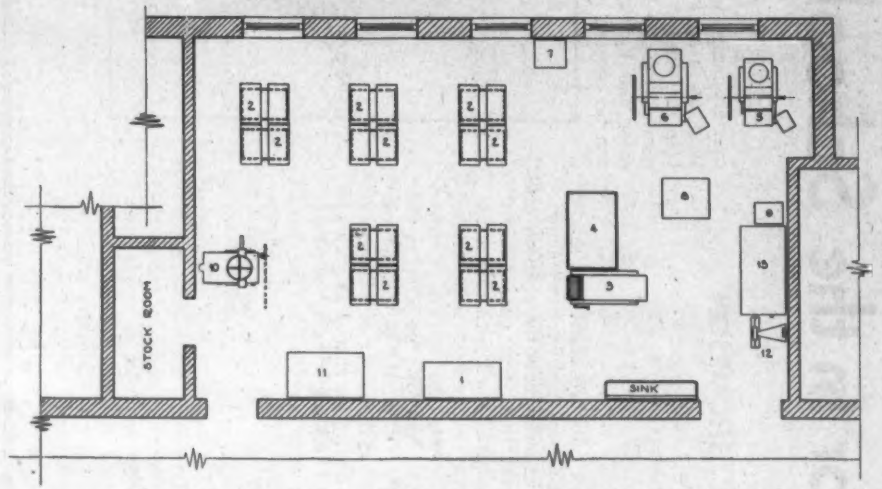


Fig. 4. Equipment shown in Fig. 3 re-arranged functionally to increase operating efficiency and safety

Legend:

1. Instructor's Desk
2. Type Cabinets
3. Proof Press
4. Imposing Table
5. 10 x 15 Platen Press
6. 12 x 18 Platen Press
7. Hand Leer Press
8. Drying Rack
9. Ink and Roller Cabinet
10. Paper Cutter
11. Table
12. Stitcher
13. Bindery Table

Color in the School Shop

JOSEPH C. THOMPSON
Pittsburgh, Pa.

The interior color treatment of a school shop must be approached from two angles. Of primary importance is the creation of an environment that is at once pleasant and stimulating. Coupled with this is the use of finishes that possess sufficient resistance to withstand the rigors of repeated washing and cleaning. All too often in the past the question of durability was the sole factor influencing the choice of school-shop colors. Such dull, drab shades as "schoolhouse brown," "hallway cream," and "machine gray" were accepted as the most economic choice. This resulted in school-shop interiors that had about as much appeal as an 18th-century foundry.

Taking a tip from experience of modern industry, school-shop administrators are finding that maximum economy can be obtained only when the color scheme is based on an engineered color pattern. The savings flowing from color scientifically used can be measured in terms of conservation of human resources as well as reduction in over-all maintenance costs. In a school shop, as in an industrial plant, color can help the student do better work with less mental and physical strain. By correlating color and lighting, considerable economy can be affected in illumination costs. The pleasant atmosphere of proper colors induces habits of cleanliness. This in turn reduces maintenance and loss to property from thoughtless, but none the less damaging, petty vandalism.

Modern science has established the fact

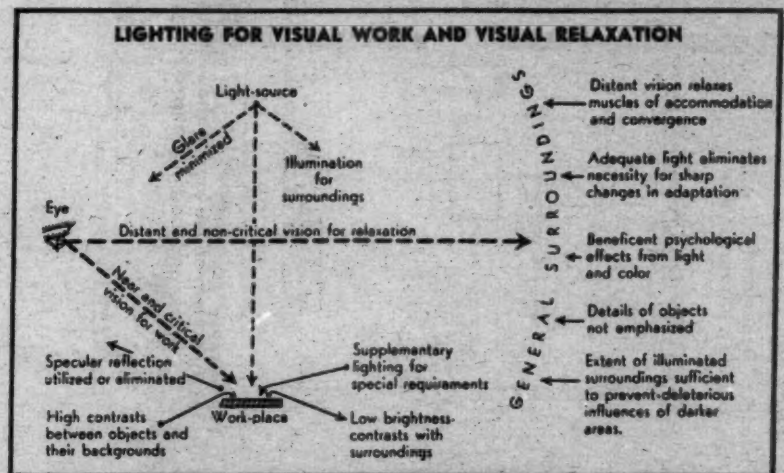
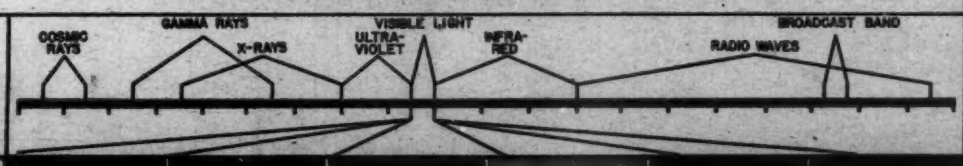

LIGHTING FOR VISUAL WORK AND VISUAL RELAXATION
Light-source
Glare minimized
Illumination for surroundings
Eye
Distant and non-critical vision for relaxation
Near and critical vision for work
Speculer reflection utilized or eliminated
Supplementary lighting for special requirements
High contrasts between objects and their backgrounds
Work-place
Low brightness contrasts with surroundings
GENERAL SURROUNDINGS
Distant vision relaxes muscles of accommodation and convergence
Adequate light eliminates necessity for sharp changes in adaptation
Beneficent psychological effects from light and color
Details of objects not emphasized
Extent of illuminated surroundings sufficient to prevent deleterious influences of darker areas.

Fig. 1. There are many factors entering into the determination of the proper amount of lighting at the working level in school shops. Some of these are shown above

THE PRINCIPLES OF COLOR DYNAMICS

CHARACTERISTICS OF PRIMARY AND SECONDARY COLORS OF THE VISIBLE SPECTRUM USED TO DETERMINE THEIR FUNCTIONAL USES



HUE	VIOLET	BLUE	GREEN	YELLOW	ORANGE	RED
WAVE LENGTH	17 MIL. OF 1 INCH	19 MIL. OF 1 INCH	20 MIL. OF 1 INCH	22 MIL. OF 1 INCH	25 MIL. OF 1 INCH	30 MIL. OF 1 INCH
TYPE OF COLOR	COOL	COOL	COOL	WARM	WARM	WARM
MUSCULAR REACTION	——	24 UNITS	28 UNITS	30 UNITS	35 UNITS	42 UNITS
COMPLEMENTARY COLOR	YELLOW	ORANGE	RED	VIOLET	BLUE	GREEN
PRIMARY ASSOCIATIONS	RICH-FORMAL-LUXURY-ROYALTY	COOL-REMOTE-CALM-SOMETIMES DEPRESSING	WARMTH OF YELLOW-COOLNESS OF BLUE-NATURE REFRESHING	SUN WARMTH-STIMULATING	BRILLIANCE-CHEER-VISIBILITY	DANGER-FIRE-SOMETIMES IRRITATING
THERAPEUTIC VALUE	CALMS THE MIND-QUIETS THE BODY	REDUCES MUSCULAR TENSION	CALM PEACEFUL EFFECT	STIMULATING-OVERCOMES DEPRESSION	PARTAKES OF NATURE OF RED & YELLOW	STIMULATING EFFECT

Fig. 2. Principles of color dynamics

that color is a specific industrial and teaching aid. By employing color as outlined in the principles of color dynamics, schools and factories have increased efficiency and production because color possesses inherent power. See Figure 2. This stems from the fact that color as light is the visible segment of the electromagnetic spectrum which also contains the ultraviolet, infrared, and other invisible rays. If the latter have power or energy, it is logical to conclude that the visible rays have similar power. This has been proved in many different tests. For example, some colors actually increase muscular reaction; others have a pronounced effect on the mind. Many colors make a person feel warm; others impart a feeling of coolness. Some colors create illusions making objects appear larger or smaller. There are certain shades that impart sadness and grief and others that connote happiness and cheer.

By understanding and employing the basic characteristics of color, the school maintenance engineer can literally work wonders in the school shop. Like a machinist shaping a piece of metal from a blueprint, he can with skillful patterning, in accord with dynamic principles create school-shop interiors that are both efficient and attractive. This has been graphically demonstrated recently in the educational field at the Northrop Aeronautical Institute, Hawthorne, Calif. The principles of color dynamics were used in the industrial training rooms after color had proved its efficiency in the Northrop Aircraft shops during the war. It is estimated that the efficiency of the students has increased approximately 60 per cent through use of carefully selected eye-rest and cheerful colors.

Characteristics of Color

Each color has certain psychologic, symbolic, and visual characteristics which must be considered in planning the most effective color scheme for a school shop. These characteristics may be classified generally as follows:

1. *Warm and Cool Colors.* Warm colors are those in the range of yellow, orange, and red. They suggest heat, blood, sunshine. In school rooms they are used to compensate for lack of natural illumination and are used for northern or eastern exposure. Cool colors are those in the blue range and suggest ice, snow, and clear cold water. They are used for an effect of calmness and restraint. In schools they can be employed to counteract an overabundance of sunlight from a western or southern exposure.

2. *Advancing or Retreating Colors.* Warm colors are generally classified as advancing colors because they have the power to make surfaces appear to come forward. Cool colors tend to make surfaces on which they are used recede. These qualities of color make it possible to use color to alter visually the proportions of a school shop.

3. *Stimulating, Relaxing, and Calming Colors.* Generally speaking the warm colors are those that stimulate and promote efficiency. When properly used they create a most pleasant environment. Of all colors known, green has the most relaxing effect on mind and body. Nature's extensive use of green in field and forest is ample evidence of this. Various shades of green such as Eye-Rest, Vista, and Seafoam form the basis of properly engineered color schemes in a majority of instances in the school. Blue is a calming color and can be used extensively in the form of Cascade Blue and Stratosphere Gray in the schools to promote peace of mind and a calm, quiet atmosphere conducive to concentration.

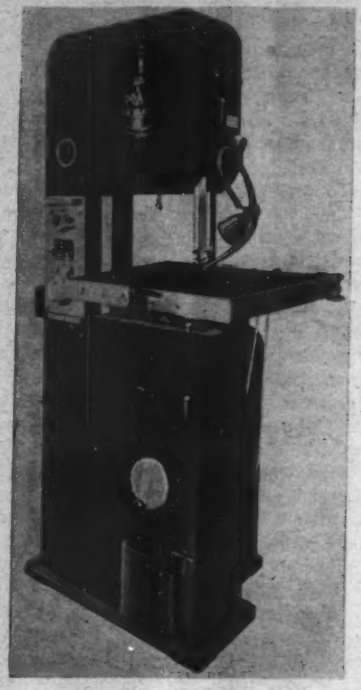


Fig. 3. Many manufacturers of school shop machinery are now beginning to paint their products in a scientific manner. For example, the principles of color dynamics, the use of eye-rest and focal colors has been carried out on this saw. The background is in eye-rest green and the moving or critical parts are in various focal colors

Color for Machines

After the general colors have been selected in conformance with the size, location, and other physical details of the school shop, the next important step is the placement of the colors. As with the actual color choice, the placement will be made in accord with the physical characteristics of the shop and equipment. On the shop machinery, for example, color's first job is to create a visual working area that minimizes eye fatigue. Color must separate the critical from the noncritical parts and, where possible, visually divorce the critical machine parts from the material worked upon. By doing so, eye wander is minimized. The eye can pick up where the fabrication starts and ends. Less eye fatigue is the result.

To do this a color that comes quickly to the eye — a color that moves in strong contrast to the stationary machine parts — is used on the operating parts. These are known as focal colors and include focal ivory, red, orange, and many others. The primary purpose of a focal color is, in combination with contrasting colors, to focus the student's attention exactly where it should be — on the material being worked — with the least possible effect on the eye muscles. As the critical parts of the machinery must "move forward," the stationary part must drop back. The widely used "machine gray" does this to a certain degree. However, gray is not only a depressing color, but it absorbs light and reduces illumination at the working level. Some grays absorb over 80 per cent of the light striking them. After much research a receding green shade has proved most adaptable for the nonoperating machine body. No other color has such a relaxing and soothing effect on the human eye. In practically all its variations the wave lengths of green more closely ap-

Fig. 4. The effect of proximity of colors. Any band or area of color appears darker along its edge adjoining a lighter color, or when placed on a light background. Likewise, the reverse of this illusion applies. Sometimes it is more desirable to take advantage of this illusion than it is to attempt to overcome it. In school shops this illusion must be avoided because constant fixation upon such an illusion will cause vibration and eye-fatigue

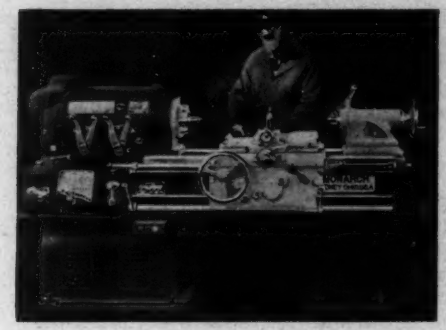


Fig. 5. Basis of the principles of color dynamics is the use of focal colors in contrast with eye-rest surfaces. These focal colors are used to highlight the moving or critical parts of machinery, in such a manner that they are always visible to the operator with the least possible visual effort. Focal ivory, buff, and beige are used predominantly to highlight moving parts nearest the material being worked upon while focal orange, red, and yellow are used for danger areas

proximate the 5500 angstrom units which lighting engineers have found ideal for minimum eye fatigue; since psychologically it is the most restful as compared to the other extremes of the spectrum, violet, and red.

Safety considerations come next, and orange is used on start-stop buttons for easy identification. Focal yellow, a high-visibility color, is used on control levers for quick and sure identification.

Wall and Ceiling Treatment

Where machine colors must emphasize direct eye ease and visual relaxation for the student, wall and ceiling colors have additional tasks to perform. They must properly diffuse illumination and create a pleasant atmosphere, as well as contribute their share to ease of seeing. Color is an indispensable accessory for proper lighting and is a highly effective agent for converting available illumination into high-quality, usable light at the working level. Most locations in the school shop should have at least 35 foot-candles, sometimes more but never less. This can be attained by using ceiling colors with 75 to 85 per cent reflectivity and wall colors with a light-reflecting power of 50 to 60 per cent.

Although white has a very high reflecting power, it should be used most carefully, such as in special ceiling treatment in the school shop. It should also be a dead flat white or at least one of low-sheen characteristics to properly diffuse the light. Diffused reflection improves light quality whereas whites having high sheen or gloss reflect light specularly. See Figure 7. It is specular reflection that bounces a light ray to the eye from a surface in the same shape and form as it emanates from the light source. Such specular reflection produces glare which in turn produces eye-strain, headaches, and physical fatigue. If direct lighting is used, ceiling reflection is minimized and the use of color may be employed.

Various colors have been developed for treating walls, ceilings, and other school-shop surfaces that will diffuse light and produce maximum *quality* and *quantity* of illumination. Among these are Cascade Blue and Stratosphere Gray for ceilings. These contain sufficient white to make them efficiently reflective and enough color to hide properly. Being cool colors they have the power to make objects recede, and in doing so the feeling of clutter from crowded overhead beams and pipes is relieved. Various shades of green and yellow were developed for the walls, the use of either depending upon various physical factors such as location and size. Eye-Rest Green, for example, is placed on walls directly in line with machine operators' vision. Being an eye-rest color, and being in the same color family as Vista Green used on the machines, little eye muscle change is required and eye fatigue is lessened. Contrast this to the dark gray machines and the white walls formerly used in the shops. Here the eye goes through a maximum change and eye fatigue is great.

Suntone, a beautiful soft yellow, is used on end walls not directly in the path of vision to improve morale and giving beauty and contrast to the surroundings. Floors are contrasted with two shades of gray divided by an orange strip to zone the aisles. While not so important in school shops as it is in factories to minimize danger, it is used to give the apprentice a start in good safety practices, for later on in factories he will meet these conditions. In aviation school shops, floors are given special attention and are often painted white to increase reflectivity. Bins, lockers, etc., may be painted with colors denoted as Rose Tan or Sand for warmth, contrast, and beauty.

Durability Improved

Prior to development of special ingredients for finishes, it was practically impossible for the school shop to take advantage of the power and energy in color. As in industry, the maintenance finishes in a school shop have to be most durable and the most durable finishes are limited in color. One of the most significant advances in making maintenance finishes both durable and attractive was the production of synthetic resins. When incorporated into the formulation of wall,

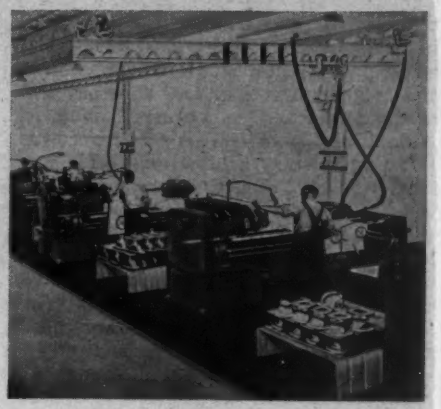


Fig. 6. The general overall cleanliness and subsequent orderliness that can be achieved with the scientific use of colors is graphically demonstrated in this view of a section of a large metalworking shop. Although presented here in a black and white photo, the visibility of critical machine parts, moving equipment, and traffic aisles is clearly defined. The overhead maze of girders, pipes, supports, etc., has been made to recede with use of cascade blue while uses of yellow for the crane accentuates this moving part

trim, and machinery finishes these resins import most desirable characteristics. This type finish possesses excellent color retention, durability, heat resistance, and has a soft, rubbed-sheen effect.

Synthetic resins are a product of the paint laboratory. They are built up by the paint chemist through the union of various compounds. The complex process is known as molecular reorientation. The resins are combined with specially processed oils to form synthetic vehicles of many types. Of these, and the number of potentialities is practically unlimited, the most adaptable for use in school-shop finishes is the glyceryl phthalate type. They result from a chemical union of drying oils with phthalic anhydride and glycerine. In this reaction the ingredients combine to form complex molecular structures that are known as the oil-modified alkyd resins.

Finishes with this type resin provide the most satisfactory answer to school-shop maintenance problems. These resins help form a hard, tough, and flexible film possessing unusual resistance to gasoline, grease, oil, water, and other things. They possess unusual properties of adhesion, and

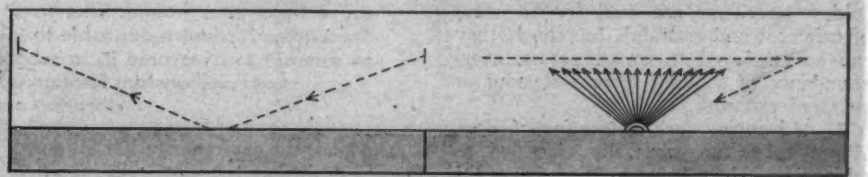


Fig. 7. Two types of reflection. To provide maximum ease of seeing in the school shop, light must be thoroughly diffused or broken up. A ray of light which is reflected from a brilliant white surface is merely deflected away from that surface in the same shape or form and at the same angle in which it reaches the surface. (See left above). This is known as specular reflection. By using tested colors in special finishes this light can be properly reflected or diffused as shown right above. Diffuse reflection "sprays" the light over a large area. This reduces glare and excessive brightness.

mar and chip resistance and defense against normal cleaning compounds is excellent. This factor is of particular importance in the school shop, where repeated washing takes place. The heat resistance of oil-modified alkyd resins is by far greater than finishes with other ingredients and drying time is considerably faster, making for economy in application.

New Type Machinery Enamels

When used in formulating machinery enamels, the alkyd synthetic resins make possible a much improved finish. Such enamels possess excellent durability under extreme conditions and are ideal for use on school-shop machines and equipment. No matter how careful a student is in operating a machine, there is apt to be an overflow of machine oils on the finish. Often this oil softens and penetrates the finish, leaving in its wake a discolored area, the surface resistance of which is considerably weakened. This in a short time decomposes and the metal becomes exposed.

The problem of maintenance finishes for school shops is essentially similar to that of industrial plants. Just as no factory would consider using resin emulsion flat wall paints or inferior flats, so should the school shop avoid them. In both places, finishes must be capable of withstanding many washings and thus must be resistant to severe abrasion from the chemicals and ingredients of washing compounds. A good reliable wall sealer must still be used in school shops for greatest economy. This eliminates the suction and porosity of the old paint film and provides a much more adhesive surface for the final coat of flat or eggshell wall paint.

Maintenance paints in the school shop, being more durable, possess a slightly higher sheen than the average flat wall paint. They, however, should not be so high as to cause specular reflection. When viewed "head on" the sheen should be visually nonexistent and impart the impression of depth and beauty of a flat finish. At an angle, however, the sheen should be sufficient to reflect illumination in a diffusing manner without causing glare. Through use of synthetic resins and highly perfected oils and careful formulation, special maintenance finishes have been developed to meet this specific need. These have been produced in both eggshell and semigloss ranges.

Other Special Finishes

Another special finish, in hues that exactly match the wall paints, has been developed for dado and other areas that are subject to hand dirt and scuffing. This is recommended for interior wood sash, doors, tool cabinets, lockers, benches, tables, and other similar equipment in the school shop. For most efficient service this type finish should be applied over undercoaters, as better adhesion is obtained which imparts additional durability. Once again, the alkyd glyceryl phthalate formulation makes the quality outstanding, with good lasting characteristics.

The floor of the school shop should receive special attention. If it is concrete, preparation should include etching with a solution of muriatic acid made by diluting one part acid with three parts water. This provides a better "bite" for the alkyd resin concrete-floor enamel. Wood floors are, for the most part, finished with penetrating varnishes which do not leave a film. However, many shops will want to follow industrial practice and use enamel. A satisfactory floor enamel must resist extreme wear, withstand constant mopping and scrubbing with chemical solutions, and must have high adhesive qualities. Enamels containing synthetic alkyd resins in special formulation will meet these demands. They can be produced in a small range of colors that permit their integration in an overall scientific color pattern.

The new technological developments in maintenance finishes plus the knowledge of scientific color application now makes it possible for the average school shop to have a decorative pattern that is both beautiful and durable. No longer should measures of economy and durability be the barrier to making the shop as attractive as other rooms of the modern school. By careful choice of finishes and proper selection of colors, the atmosphere of the school shop can be transformed into a direct teaching aid.

Installation and Maintenance of Woodworking Equipment*

ROBERT E. HOLLAND
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The writer sometimes doubted whether sufficient instruction in the installation and maintenance of woodworking equipment, especially of the power type, is given in the public schools and industry to young men about to become journeymen or vocational teachers in the various woodworking trades. He, therefore, proceeded to secure data to support or to disprove this tentative hypothesis. He hoped to obtain a better understanding of the actual position of the student, teacher, and others in regard to the installation and maintenance of woodworking equipment.

The specific purposes of this study were:

1. To discover what actual work is done by students of the tenth, eleventh, and twelfth grades, and by the teachers and others such as the janitor, school maintenance employees, and various outside repair shops in the installation and maintenance of woodworking equipment in the woodshops of the vocational schools in Pennsylvania.

2. To compare the percentage of teachers who perform work on the installation and maintenance of woodworking equipment, with or without extra compensation, as against the same work that is performed by others, students excluded.

3. To discover the position of students, teachers, and others in regard to a few miscellaneous items such as cleaning the shop, checking benches, tool cabinets, and toolroom before class dismissal, etc.

4. To analyze and interpret the data collected and to make recommendations based on the findings.

Methods and Procedures

The study was begun by a comprehensive survey of the available books and pamphlets pertaining to the subject in order to supplement my personal efforts in the compilation of a questionnaire which would give the desired information.

The resulting questionnaire containing sixty items to be checked by vocational industrial teachers in either pattern-making, cabinetmaking, or carpentry was mailed to sixty local directors of vocational education and superintendents of schools in Pennsylvania. With the aid of a post

*Abstract of a term paper completed under the direction of Dr. S. Lewis Land for Industrial Education 501V, "Seminar in Vocational Education," *The Pennsylvania State College*, June, 1946.

card follow-up, a total of 52 or 86.6 per cent of those contacted returned the questionnaires.

Since the items on the questionnaire were grouped into hand tools, power machinery, and miscellaneous items, this same grouping was used in conjunction with the specific purposes of the study in the presentation and interpretation of the findings.

Summary of the Findings and Conclusions

For the most part the students get experience in keeping their hand tools in condition. In a summation of the percentage of students doing work at some time before leaving the twelfth grade on the various items pertaining to the maintenance of hand tools, it was found that ten of the twenty items rated 90 per cent or over in student participation. They are as follows: grind chisels, whet chisels, grind outside gouges, whet outside gouges, whet inside gouges, grind plane irons and whet plane irons, all 100 per cent; grind inside gouges, 95 per cent; grind spokeshave blades, 90 per cent; and whet spokeshave blades, 90 per cent. Items having a rating of 76 to 89 per cent in student participation include: sharpening cabinet scrapers, 89 per cent; apply protective agents to hand tools before vacation, 84 per cent; clean hand tools for school term, 83 per cent; whet drawknives, 79 per cent; and grind drawknives, 76 per cent. The remaining items rate as follows: sharpen twist drills, 65 per cent; joint, set, and file hand ripsaws, 63 per cent; joint, set, and file hand backsaws, 57 per cent. It must be remembered that the above figures do not represent percentages of students' 100 per cent participation since teachers and others are assisting in 37 per cent of the above work to a degree that is not known from data received in this study. For example, if 26 of the 52 teachers had indicated that their students had the opportunity to sharpen twist drills, the percentage of student participation would be reported as 50 per cent. No further breakdown was attempted.

The writer can see no reason why the above figures should not approach the 100 per cent mark in student participation. A good mechanic should know the importance of sharp tools; he should know how to sharpen them and he should be able to keep them in the best possible condition. Students need more actual work in the maintenance of hand tools.

Students do very little of the actual work involved in the installation and maintenance of woodworking machinery. The work done by over 50 per cent of the students is as follows: installation of mortiser bits, 92 per cent; installation of circular saws, 82 per cent; installation of shaper cutters, 73 per cent; installation of thickness planer knives, 64 per cent; and the installation of jointer knives, 59 per cent; also, various miscellaneous items such as lubrication of machines, 96 per cent; cleaning machines before school term, 95 per cent; coiling band saw blades, 92 per cent; and applying protective agents to machines, 89 per cent. Items in which student participation rates from 29 to 49 per cent are as follows: set and file circular saws, 49 per cent; join belts, 48 per cent; mount and fasten machines, 46 per cent; dress grinding wheels, 44 per cent; grind and whet thickness planer knives, 41 per cent; sharpen mortiser bits, 38 per cent; joint circular saws, 35 per cent; line up shafts and pulleys, 32 per cent; care and maintenance of lathe centers, 31 per cent; and braze broken band saw blades, 29 per cent. The following items rate below 15 per cent: clean and repair electric motors, 13 per cent; adjust play in bearings, 10 per cent; install electric motors, 4 per cent; and replace babbitt bearings, 4 per cent. The above figures do not represent the percentages of students' 100 per cent participation since, in most cases, there is some degree of assistance by teachers and others.

In order to interpret better, the small amount of work done by students in several items on the installation and maintenance of woodworking machinery, the following figures show the percentage of shops in which the work is done *entirely by teachers and others* without receiving any student help. The figures are as follows: sharpen mortising chain saws, 100 per cent; install electric motors, 98 per cent; replace babbitt bearings, 96 per cent; clean and repair electric motors, 91 per cent; adjust play in bearings, 89 per cent; line up shafts and pulleys, 71 per cent; braze broken band saw blades, 71 per cent; care and maintenance of lathe centers, 70 per cent; grind and whet thickness planer knives, 58 per cent; joint circular saw blades, 58 per cent; grind and whet jointer knives, 57 per cent; and dress grinding wheels, 57 per cent. Also, sharpen mortiser bits, 55 per cent; mount and fasten machines, 55 per cent; sharpen shaper cutters, 54 per cent; join belts, 53 per cent; set and file circular saw blades, 50 per cent; install jointer knives, 44 per cent; grind and whet wood trimmer knives, 38 per cent; and adjust and track a band saw blade, 31 per cent.

It is agreed that the average mechanic should be more concerned with the tools in his toolbox, but it is the writer's opinion that students should have a better knowledge and understanding of proper installation and maintenance of woodworking machinery. Instruction should be improved in this phase of work.

The results of four items which concern the safety of students to a great extent are worthy of mention. The items involve the checking of student installation of jointer knives, thickness planer knives, shaper cutters, and circular saw blades before operating the machines. Four of the teachers allowed their students to install jointer and thickness planer knives and begin operation of the machines without any check on the part of the teacher. Eleven teachers did not check installation on the

Radio and electric repair, Booker T. Washington Technical High School, St. Louis, Mo. Photograph submitted by Warren K. Begeman, Director, Technical Education and Industrial Arts, St. Louis, Mo.

shaper and seven did not check circular saws before operation. With the large number of teachers who *insist* on doing all the checking for the above items, the writer believes that a few teachers would become more safety conscious after an inspection of the data received in this study. Undoubtedly a few teachers in their attempt to make student activity appear very good overlooked the few items involving the safety of the student. At least, it is hoped that this interpretation is correct.

In comparing work done by teachers and others, it was found that over 50 per cent of the band saw blades are brazed outside the woodshop. Three of the 49 teachers stated that they would not use band saw blades which had been brazed.

Most of the installation of machinery and work on electric motors is done by other school shops and school maintenance employees. Approximately one third of the grinding and whetting of thickness planer knives and jointer knives is done in a like manner.

There is a tendency to have beginning students do work such as clean the shop, apply protective agents to hand tools and machines before vacation, clean hand tools and machines before school term, and resurfacing of bench tops. However, 12 of the teachers had the janitors do all of the cleaning. In most cases, it appears that the janitor is not wanted in the finishing room.

Although the relative size of the study and the nature of the course for which the study was conducted did not permit further interpretation of the data, the writer is of the opinion that many additional significant and helpful facts may be obtained from information received on the returned questionnaire.

Recommendations

1. It is recommended that all students be capable of keeping the common hand tools in A-1 condition before leaving the twelfth grade.

2. It is recommended that all students receive at least forty hours of instruction and work opportunities in the installation and maintenance of woodworking machinery at well-planned intervals at some time before graduation.

3. It is recommended that all teachers plan courses of study to meet the needs mentioned in the foregoing.

4. It is recommended that a few of the teachers reporting become more safety conscious on items involving the checking of student installation before operation of machines.

5. It is further recommended that the teachers do less of the work on the installation and maintenance of hand tools and woodworking machinery in order that the students may do more of this work. Use old saws, chisels, etc., for student practice if they cannot be trusted with good equipment at the beginning. It is not necessary to turn the shop into a repair shop. Give the students a fair amount of actual work and have the remainder of the work done by others outside the shop. Teachers should concentrate on instruction and not on being disciplinarians, *maintenance men*, and janitors.

Junior High School Metal-Shop Equipment

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During the past few years increasing emphasis has been placed upon the industrial-arts shop offerings and the school systems. Particular importance has been placed on the addition and enlargement of metal-shop offerings. Many questions have been raised by the instructors in the field as to the specific areas of metal work which should be developed. They are also concerned about the tools and items of equipment which are necessary for each of the areas of metalworking which might be included in a junior high school metalworking program. This study is an attempt to answer these questions and to give the instructors in the field a basis for their offerings. It is also an attempt to determine those tools and items of equipment which are most essential to a successful offering in the various areas of metalworking.

Twenty-two metalwork textbooks were examined, and a list of 160 tools and items of equipment was made for inclusion in a questionnaire. Three tool catalogs were consulted to settle discrepancies in tool descriptions and names.

Seventy questionnaires were mailed to 56 junior high school metalwork instructors located in 33 Iowa cities. Ten cities were known to offer no metalwork at the junior high school level. Replies were received from 35 schools in 21 cities. Of the 35 replies to the questionnaire, 8 were unanswered, accompanied by an explanation that no metalwork was being offered in the school during the current year. Twenty-seven completed questionnaires were used as the basis of this study.

In the analysis of the data, the tools and items of equipment were grouped by instructional units. These units are: sheet-metal work, welding, machine-shop practice, forging and founding, art-metal work, and automobile mechanics. In addition, many tools were found to be necessary to two or more of the afore-stated work areas.

To evaluate the necessity of each item, 2 points were given for each reply stating the item as essential, 1 point for desirable and 0 for a reply that the item was of no value. The maximum point value any item could receive was 54. For purposes of this study it was arbitrarily assumed that any item with a point value of less than 18 has no place in the average Iowa junior high school shop; those of 36 or more as essential; and those between 18 and 36 as desirable but not essential.

The number of each item deemed necessary for a class of 25 boys was determined by dividing the total number of units reported as necessary by the number of instructors so stating.

The tools included in this study were divided into 8 major categories according to the areas of metalwork for which the tools are designed and used. These are, in order of preference or average point value: tools which are common to two or more areas of metalworking; sheet-metal hand tools; sheet-metal machines; tools for machine-shop practice; tools for automobile mechanics; art-metal tools; forge and foundry tools; and welding equipment.

Forty-three tools fall into the classification of belonging to two or more areas of metalwork. Using the foregoing method of evaluation, 33 of these items are essential and 10 desirable to the successful operation of a junior high school metalworking shop. Most of these were available in the junior high schools for the activities included in their present offerings. This availability of tools suggests that metalworking might be added to the curricula of many junior high schools with the addition of very little, if any, equipment. See Table I.

Sheet-metal work appears to be the area most adaptable to the junior high school metalworking program. This study revealed that the hand processes are more satisfactory and profitable than machine processes for junior high school purposes.

TABLE I. General Tools

Item of equipment	Shops having tool: Yes No.	Yes Per cent	No No.	No Per cent	Reported value: Essential No.	Essential Per cent	Desirable No.	Desirable Per cent	No value No.	No value Per cent	No. necessary for a class of 25 boys: Point value	Range	Ave.
Hack saw	26	96.3	1	3.7	27	100.0	0	0	0	0	54	2–15	6
Dividers	26	96.3	1	3.7	27	100.0	0	0	0	0	54	2–12	6
Ball-peen hammer	27	100.0	0	0	26	96.3	1	3.7	0	0	53	6–42	13
Screw driver	27	100.0	0	0	26	96.3	1	3.7	0	0	53	3–25	11
Center punch	26	96.3	1	3.7	26	96.3	1	3.7	0	0	53	1–18	7
Mill file	27	100.0	0	0	26	96.3	1	3.7	0	0	53	6–50	16
Oilstone	26	96.3	1	3.7	26	96.3	0	0	1	3.7	52	1–6	3
Goggles	22	81.5	5	18.5	25	92.6	1	3.7	1	3.7	51	1–25	5
Rule	26	96.3	1	3.7	25	92.6	1	3.7	1	3.7	51	4–25	17
Anvil	24	88.9	3	11.1	22	81.5	4	14.8	1	3.7	48	1–12	4
Steel framing square	26	96.3	1	3.7	22	81.5	4	14.8	1	3.7	48	1–8	4
Wheel dresser	22	81.5	5	18.5	22	81.5	4	14.8	1	3.7	48	1–2	1
Crescent wrench	23	85.2	4	14.8	22	81.5	4	14.8	1	3.7	48	1–10	3
Monkey wrench	13	48.1	14	51.9	22	81.5	4	14.8	1	3.7	48	1–12	3
Try square	24	88.9	3	11.1	23	85.2	1	3.7	3	11.1	47	1–25	12
Side-cutting pliers	22	81.5	5	18.5	20	74.1	7	25.9	0	0	47	1–25	6
Bench grinder	25	92.6	2	7.4	22	81.5	2	7.4	3	11.1	46	1–4	2
Twist drill	22	81.5	5	18.5	22	81.5	2	7.4	3	11.1	46	1–6	2
"C" clamps	22	81.5	5	18.5	20	74.1	6	22.2	1	3.7	46	2–36	12
Machinist's vise	21	77.8	6	22.2	21	77.8	3	11.1	3	11.1	45	1–25	10
Drill press	24	88.9	3	11.1	21	77.8	3	11.1	3	11.1	45	1–5	2
Hand drill	23	85.2	4	14.8	21	77.8	3	11.1	3	11.1	45	1–6	3
File card	21	77.8	6	22.2	21	77.8	2	7.4	4	14.8	44	1–12	6
Compass	21	77.8	6	22.2	19	70.4	5	18.5	3	11.1	43	1–12	5
Wire brush	21	77.8	6	22.2	19	70.4	5	18.5	3	11.1	43	1–12	4
Awl	19	70.4	8	29.6	18	66.7	6	22.2	3	11.1	42	1–25	10
Nippers	17	62.9	10	37.1	18	66.7	6	22.2	3	11.1	42	1–12	3
Pipe wrench	17	62.9	10	37.1	18	66.7	5	18.5	4	14.8	41	1–6	3
Flat chisel	24	88.9	3	11.1	17	62.9	7	25.9	3	11.2	41	2–25	7
Marking gauge	18	66.7	9	33.3	17	62.9	5	18.5	5	18.6	39	1–25	9
Scriber	19	70.4	8	29.6	16	59.3	7	25.9	4	14.8	39	3–25	9
Drill press	16	59.3	11	40.7	18	66.7	3	11.1	6	22.2	39	1–6	2
T-bevel	18	66.7	9	33.3	16	59.3	6	22.2	5	18.5	38	1–6	2
Prick punch	15	55.6	12	44.4	14	51.9	7	25.9	6	22.2	35	1–12	6
Jacobs chuck	17	62.9	10	37.1	13	48.1	8	29.6	6	22.3	34	1–6	2
Protractor	17	62.9	10	37.1	13	48.1	9	33.3	5	18.6	35	1–12	3
Portable electric drill	11	40.7	16	59.3	8	29.6	15	55.6	4	14.8	31	1	1
Knife	17	62.9	10	37.1	12	44.5	7	25.9	8	29.6	31	1–25	8
Pipe vise	8	29.6	19	70.4	8	29.6	15	55.6	4	14.8	31	1–2	1
Breast drill	15	55.6	12	44.4	12	44.4	6	22.3	9	33.3	30	1–4	2
Slip stone	12	44.4	15	55.6	9	33.3	11	40.8	7	25.9	29	1–6	2
Pipe cutter	11	40.7	16	59.3	5	18.5	16	59.3	6	22.2	26	1–2	1
Steel tape	6	22.2	21	77.8	6	22.2	13	48.2	8	29.6	25	1–4	1

TABLE II. Sheet-Metal Hand Tools

Item of equipment	Shops having tool: Yes No.	Yes Per cent	No No.	No Per cent	Reported value: Essential No.	Essential Per cent	Desirable No.	Desirable Per cent	No value No.	No value Per cent	No. necessary for a class of 25 boys: Point value	Range	Ave.
Soldering copper	26	96.3	1	3.7	26	96.3	1	3.7	0	0	53	4–25	9
Straight-blade tin snips	27	100.0	0	0	26	96.3	1	3.7	0	0	53	2–18	9
Assorted stakes	24	88.9	3	11.1	23	85.2	4	14.8	0	0	50	1–3	1
Soldering furnace	23	85.2	4	14.8	24	88.9	1	3.7	2	7.4	49	1–12	3
Curved-blade tin snips	24	88.9	3	11.1	22	81.5	4	14.8	1	3.7	48	1–12	4
Rivet set	25	92.6	2	7.4	23	85.2	2	7.4	2	7.4	48	1–15	6
Riveting hammer	21	77.8	6	22.2	18	66.7	5	18.5	4	14.8	41	2–25	8
Wooden mallet	21	77.8	6	22.2	18	66.7	3	11.1	6	22.2	39	2–25	13
Wire gauge	13	48.2	14	51.8	15	55.6	8	29.6	4	14.8	38	1	1
Bench plate	15	55.6	12	44.4	13	48.2	9	33.3	5	18.5	35	1–4	2
Straightedge	12	44.4	15	55.6	13	48.2	6	22.2	8	29.6	32	1–25	4
Electric soldering iron	17	62.9	10	37.1	10	37.0	11	40.8	6	22.2	31	1–12	3
Hollow punch	16	59.3	11	40.7	12	44.5	7	25.9	8	29.6	31	1–12	4
Hand seamer	14	51.8	13	48.2	9	33.3	12	44.5	6	22.2	30	1–25	5
Rawhide mallet	12	44.4	15	55.6	9	33.3	11	40.8	7	25.9	29	1–18	6
Setting hammer	13	48.1	14	51.9	10	37.0	8	29.6	9	33.4	28	1–12	5
Trammels	9	33.3	18	66.7	8	29.6	9	33.4	10	37.0	25	1–2	1
Blowtorch	13	48.1	14	51.9	3	11.1	16	59.3	8	29.6	22	1–2	1
Grooving tools	5	18.5	22	81.5	5	18.5	9	33.3	13	48.2	19	1–6	3
Fiber mallet	4	14.8	23	85.2	1	3.7	11	40.7	15	55.6	13	1–12	3

TABLE III. Sheet-Metal Machines

Item of equipment	Shops having tool: Yes No.	Yes Per cent	No No.	No Per cent	Reported value: Essential No.	Essential Per cent	Desirable No.	Desirable Per cent	No value No.	No value Per cent	No. necessary for a class of 25 boys: Point value	Range	Ave.
Barfolder	23	85.2	4	14.8	22	81.5	3	11.1	2	7.4	47	1–2	1
Beading machine	20	74.1	7	25.9	15	55.6	8	29.6	4	14.8	38	1–3	1
Form roller	21	77.8	6	22.2	14	51.8	9	33.4	4	14.8	37	1–2	1
Bench lever shears	12	44.4	15	55.6	11	40.8	12	44.4	4	14.8	34	1	1
Burring machine	20	74.1	7	25.9	11	40.8	11	40.8	5	18.4	33	1–3	1
Wiring machine	17	62.9	10	37.1	10	37.1	12	44.4	5	18.5	32	1–3	1
Squaring shears	12	44.4	15	55.6	8	29.6	15	55.6	4	14.8	31	1–2	1
Turning machine	14	51.8	13	48.2	8	29.6	13	48.2	6	22.2	29	1–2	1
Crimping machine	13	48.2	14	51.8	9	33.4	11	40.8	7	25.8	29	1–3	1
Grooving machine	12	44.4	15	55.6	5	18.5	14	51.8	8	29.7	24	1	1
Setting-down machine	7	25.9	20	74.1	5	18.5	10	37.0	12	44.5	20	1	1
Pan break	5	18.5	22	81.5	5	18.5	10	37.0	12	44.5	20	1	1
Cornice break	6	22.2	21	77.8	4	14.8	12	44.4	11	40.8	20	1	1
Ring and circle shears	3	11.1	24	88.9	5	18.5	10	37.0	12	44.5	20	1–4	1

Item of equipment	Shops having tool: Yes No.	Yes %	Shops having tool: No	No %	Reported value: Essential	Essential %	Desirable	Desirable %	No value	No value %	No. necessary for a class of 25 boys: Point value	Range	Ave.
Steel tape	6	22.2	21	77.8	6	22.2	13	48.2	8	29.6	25	1–4	1
Cornice break	6	22.2	21	77.8	4	14.8	12	44.4	11	40.8	20	1	1
Ring and circle shears	3	11.1	24	88.9	5	18.5	10	37.0	12	44.5	20	1–4	1

TABLE IV. Machine-Shop Equipment

Item of equipment	Shops having tool: Yes No.	Yes %	Shops having tool: No	No %	Reported value: Essential	Essential %	Desirable	Desirable %	No value	No value %	No. necessary for a class of 25 boys: Point value	Range	Ave.
Power Equipment													
Machine lathe	10	37.0	17	63.0	8	29.6	11	40.8	8	29.6	27	1–6	3
Milling machine	2	7.4	25	92.6	6	22.2	10	37.0	11	40.8	22	1	1
Power hack saw	1	3.7	26	96.3	1	3.8	13	48.1	13	48.1	15	1	1
Shaper	2	7.4	25	92.6	1	3.8	12	44.4	14	51.8	14	1–2	1
Hand Tools													
Outside calipers	22	81.5	5	18.5	19	70.4	5	18.5	3	11.1	43	1–6	3
Tap and die sets	19	70.4	8	29.6	18	66.7	7	25.9	2	7.4	43	1–4	2
Inside calipers	19	70.4	8	29.6	17	62.9	6	22.3	4	14.8	40	1–6	3
Countersink	16	59.3	11	40.7	15	55.6	9	33.3	3	11.1	39	1–6	2
Combination square	17	62.9	10	37.1	14	51.9	8	29.6	5	18.5	36	1–15	3
Solid punch	16	59.3	11	40.7	14	51.9	8	29.6	5	18.5	36	1–8	3
V block and clamp	9	33.3	18	66.7	11	40.7	12	44.5	4	14.8	34	1–4	2
Pin punch	14	51.8	13	48.2	12	44.5	7	25.9	8	29.6	31	1–6	3
Drill gauge	9	33.3	18	66.7	10	37.0	9	33.4	8	29.6	29	1–2	1
Reamer	12	44.4	15	55.6	6	22.2	16	59.3	5	18.5	28	1–12	3
Machinist hammer	10	37.1	17	62.9	8	29.6	11	40.8	8	29.6	27	1–12	4
Center drill	9	33.3	18	66.7	11	40.7	5	18.6	11	40.7	27	1–6	3
Micrometer	8	29.6	19	70.4	9	33.3	8	29.6	10	37.1	26	1–6	2
Depth gauge	6	22.2	21	77.8	6	22.2	13	48.2	8	29.6	25	1–6	2
Extractor, Screw, Set	7	25.9	20	74.1	6	22.2	12	44.5	9	33.3	24	1	1
Hand screw	9	33.3	18	66.7	6	22.2	10	37.0	11	40.8	22	1–24	6
Toolmakers' clamps	5	18.5	22	81.5	4	14.8	12	44.5	11	40.7	20	2–12	5
Counterbore	4	14.8	23	85.2	6	22.2	8	29.6	13	48.2	20	1–6	2
Caliper rule	5	18.5	22	81.5	2	7.4	13	48.1	12	44.5	17	1–25	4
Vernier calipers	5	18.5	22	81.5	2	7.4	13	48.1	12	44.5	17	1–3	2
Hermaphrodite calipers	5	18.5	22	81.5	3	11.1	10	37.0	14	51.9	16	1–6	2
Toolmakers' vise	1	3.7	26	96.3	2	7.4	10	37.0	15	55.6	14	1–3	1
Surface gauge	2	7.4	25	92.6	1	3.7	11	40.7	15	55.6	13	1–2	1
Screw-pitch gauge	3	11.1	24	88.9	1	3.7	10	37.0	16	59.3	12	1–3	1

TABLE V. Automobile-Mechanics Tools

Item of equipment	Shops having tool: Yes No.	Yes %	Shops having tool: No	No %	Reported value: Essential	Essential %	Desirable	Desirable %	No value	No value %	No. necessary for a class of 25 boys: Point value	Range	Ave.
Combination pliers	19	70.4	8	29.6	21	77.8	4	14.8	2	7.4	46	2–25	9
Open-end wrench sets	15	55.6	12	44.4	17	62.9	5	18.5	5	18.6	39	1–2	1
Round nose pliers	17	62.9	10	37.1	15	55.6	5	18.5	7	25.9	35	1–18	3
Flat nose pliers	11	40.7	16	59.3	12	44.5	8	29.6	7	25.9	32	1–6	3
Socket wrench sets	7	25.9	20	74.1	9	33.4	14	51.8	4	14.8	32	1–2	1
Round-nose chisel	9	33.3	18	66.7	6	22.3	14	51.8	7	25.9	28	1–5	2
Scraper	12	44.4	15	55.6	9	33.4	9	33.3	9	33.3	27	1–6	4
Diagonal pliers	8	29.6	19	70.4	9	33.4	7	25.9	11	40.7	25	1–6	2
Plastic hammer	6	22.2	21	77.8	5	18.5	13	48.2	9	33.3	23	1–6	4
Gouge chisel	7	25.9	20	74.1	5	18.5	13	48.2	9	33.3	23	1–5	2
Cape chisel	12	44.4	15	55.6	6	22.2	11	40.8	10	37.0	23	1–5	3
Box-end wrenches	8	29.6	19	70.4	6	22.2	10	37.0	11	40.8	22	1–3	1
Diamond-point chisel	4	14.8	23	85.2	4	14.8	14	51.9	9	33.3	22	1–7	2
Bolt cutter	6	22.2	21	77.8	4	14.8	14	51.9	9	33.3	22	1–3	1
Rubber mallet	6	22.2	21	77.8	3	11.1	14	51.9	10	37.0	20	1–12	2
Brass hammer	6	22.2	21	77.8	1	3.7	15	55.6	11	40.7	17	1–2	2
Lead mallet	2	7.4	25	92.6	2	7.4	11	40.8	14	51.8	15	1–4	2
Feeler gauge	1	3.7	26	96.3	2	7.4	10	37.0	15	55.6	14	1–2	1
Arbor press	4	14.8	23	85.2	1	3.7	11	40.7	15	55.6	13	1	1

TABLE VI. Art-Metal Tools

Item of equipment	Shops having tool: Yes No.	Yes %	Shops having tool: No	No %	Reported value: Essential	Essential %	Desirable	Desirable %	No value	No value %	No. necessary for a class of 25 boys: Point value	Range	Ave.
Buffer	20	74.1	7	25.9	17	62.9	6	22.3	4	14.8	40	1–5	2
Jeweler's saw	15	55.6	12	44.4	9	33.3	14	51.9	4	14.8	32	1–12	3
Forming hammer	14	51.9	13	48.1	8	29.6	14	51.9	5	18.5	30	1–6	3
Raising hammer	11	40.7	16	59.3	8	29.6	11	40.8	8	29.6	27	1–12	3
Bending fork	13	48.1	14	51.9	8	29.6	10	37.0	9	33.4	26	1–12	3
Chasing chisel	14	51.8	13	48.2	6	22.2	11	40.8	10	37.0	23	1–6	3
Needle file	9	33.3	18	66.7	7	25.9	8	29.6	12	44.5	22	2–24	10
Chasing hammer	8	33.3	19	66.7	4	14.8	12	44.4	11	40.8	20	1–6	2
Embossing hammer	5	18.5	22	81.5	4	14.8	11	40.8	12	44.4	19	1–4	2
Engraving tools	3	11.1	24	88.9	3	11.1	13	48.2	11	40.7	19	1	1
Spinning lathe	0	0	27	100.0	1	3.7	16	59.3	10	37.0	18	1–3	2
Planishing hammer	10	37.1	17	62.9	1	3.7	15	55.6	11	40.7	17	1–6	3
Blow pipe	3	11.1	24	88.9	2	7.4	12	44.5	13	48.1	16	1–3	1
Doming hammer	2	7.4	25	92.6	4	14.8	8	29.6	15	55.6	16	1–3	2
Bellying hammer	4	14.8	23	85.2	2	7.4	9	33.3	16	59.3	13	1–4	2
Silversmith's hammer	1	3.7	26	96.3	1	3.7	9	33.4	17	62.9	11	1–2	1
Neck hammer	0	0	27	100.0	1	3.7	8	29.6	18	66.7	10	1–6	2

TABLE VII. Forge and Foundry Equipment

Item of equipment	Shops having tool: Yes No.	Yes %	Shops having tool: No	No %	Reported value: Essential	Essential %	Desirable	Desirable %	No value	No value %	No. necessary for a class of 25 boys: Point value	Range	Ave.
Blacksmiths' vise	15	55.6	12	44.4	14	51.9	6	22.2	7	25.9	34	1–12	3
Tongs	13	48.1	14	51.9	12	44.5	9	33.3	6	22.2	33	1–10	4
Gross-peen hammer	7	25.9	20	74.1	5	18.5	14	51.8	8	29.7	24	1–6	2
Hardy	11	40.7	16	59.3	7	25.9	9	33.3	11	40.8	23	1–4	2
Forge	6	22.2	21	77.8	5	18.5	12	44.5	10	37.0	22	1–2	1

Very few sheet-metal machines appear to be essential to a successful sheet-metal course of study. See Tables II and III.

Production equipment such as power hack saws and shapers are of little value to the average junior high school. However, it is indicated that machine-lathe and milling-machine work might be profitably included in a general course of metalworking. See Table IV.

The evidence found in this study suggested that elementary automobile mechanics has a place in the junior high school course of study. It appears that this might best be held to a consumer or driver-maintenance level. See Table V.

Hammers designed for one specific operation in art-metal working are about the only additional equipment necessary for a comprehensive unit of art-metal working. Such processes as doming, forming, raising, chasing, embossing, and fretworking appear to be satisfactory operations for junior high school students. Metal spinning does not. See Table VI.

Forging, founding, and welding might profitably be included in a comprehensive program but appear to have very little value in the junior high school programs prevailing at the time of this investigation. See Tables VII and VIII.

The average-size junior high school metalworking shop included in this study was 43 by 25 ft., for a total floor space of 1075 sq. ft., giving 49 sq. ft. of floor space for each pupil enrolled.

TABLE VII. Continued

Item of equipment	Shops having tool: Yes No.	Yes Per cent	No No.	No Per cent	Reported value: Essential No.	Essential Per cent	Desirable No.	Desirable Per cent	No value No.	No value Per cent	No. necessary for a class of 25 boys: Point value	Range	Ave.
Straight-peen hammer	4	14.8	23	85.2	3	11.1	10	37.0	14	51.9	16	1–10	2
Heat-treatment furnace	7	25.9	20	74.1	5	18.5	12	44.5	10	37.0	22	1–3	1
Sledge	5	18.5	22	81.5	5	18.5	9	33.3	13	48.2	19	1–2	1
Blower	3	11.1	24	88.9	4	14.8	9	33.3	14	51.9	17	1–4	1
Swage	4	14.8	23	85.2	1	3.7	12	44.4	14	51.9	14	1–3	1
Rammer	2	7.4	25	92.6	0	0	9	33.3	18	66.7	9	1–6	2
Riddle	1	3.7	26	96.3	1	3.7	6	22.2	20	74.1	8	1–2	1
Shrink rule	1	3.7	26	96.3	0	0	8	29.6	19	70.4	8	1–2	1
Fuller	1	3.7	26	96.3	0	0	7	25.9	20	74.1	7	1–2	2
Flatter	0	0	27	100.0	0	0	7	25.9	20	74.1	7	1–4	2
Flask	0	0	27	100.0	0	0	5	18.5	22	81.5	5	1–2	1

TABLE VIII. Welding Equipment

Item of equipment	Shops having tool: Yes No.	Yes Per cent	No No.	No Per cent	Reported value: Essential No.	Essential Per cent	Desirable No.	Desirable Per cent	No value No.	No value Per cent	No. necessary for a class of 25 boys: Point value	Range	Ave.
Oxyacetylene welder	2	7.4	25	92.6	3	11.1	10	37.0	14	51.9	16	1	1
Arc welder	1	3.7	26	96.3	2	7.4	11	40.8	14	51.8	15	1–2	1
Cutting torch	0	0	27	100.0	0	0	11	40.8	16	59.2	11	1–2	1

The total metalworking enrollment of the schools included in this study was 2307, for an average of 88 pupils per school. An average of four classes per school gives 22 pupils per class.

Sixty per cent of the shops were located in the basement, and had concrete floors. The remaining 40 per cent were on the ground-floor level and were equipped with wooden floors.

The Creative Laboratory or Handicraft Shop

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The creative laboratory is a place where boys, girls and adults can come to make use of hands, tools, equipment, and materials to construct and develop any worthwhile project out of any medium. Such a laboratory stimulates thinking, allows the co-ordinate use of hands and mind, and offers opportunities to develop and practice desirable leisure-time hobbies.

Objectives

1. To give the individual an objective medium for expressing his ideas.
2. To provide the individual with a manipulative form of creative leisure-time expression.
3. To acquaint the individual with a variety of construction materials and to develop handiness with tools.

The Laboratory

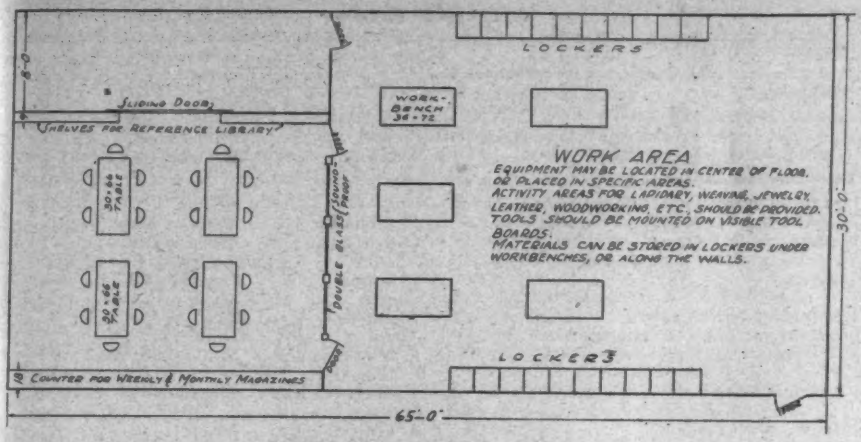
The illustration which accompanies this article shows a plan of such a laboratory. At one end of it is the planning room. This should be furnished with chairs and tables. The tables should have a smooth, hard top surface. On one side of this room is a newspaper and magazine counter. There should be available for use a wide assortment of worth-while weekly and monthly magazines. Reading of these should be encouraged, both for research assignments and educational growth. On the opposite end adjoining the darkroom are the reference library book shelves.

The planning room should be equipped with drawing and sketching equipment, and there should be several rolls of wrapping paper which can be used for layouts and patterns. The movie projector should be set up close to the darkroom and near the darkroom sliding door. In this position films can be screened whenever desired. If possible, the wall between the work area and the planning room should be of double glass and soundproofed.

The following facilities should be available in the work area:

1. Running hot and cold water
2. Outlets for natural gas
3. A good supply of electrical outlets on the walls
4. A small spray booth and adequate air pressure
5. A furnace for heating and annealing metals and facilities for quenching and cooling same
6. Several wash sinks for disposal of acids as well as water.

The aforementioned suggestions are not final. It is possible that a work area can be in operation without any of the foregoing suggestions. Those given picture the ideal setup.


LOCKERS
SLIDING DOORS
SHELVES FOR REFERENCE LIBRARY
WORK-BENCH 36-72
WORK AREA
EQUIPMENT MAY BE LOCATED IN CENTER OF FLOOR, OR PLACED IN SPECIFIC AREAS. ACTIVITY AREAS FOR LAPIDARY, WEAVING, JEWELRY, LEATHER, WOODWORKING, ETC. SHOULD BE PROVIDED. TOOLS SHOULD BE MOUNTED ON VISIBLE TOOL BOARDS. MATERIALS CAN BE STORED IN LOCKERS UNDER WORKBENCHES, OR ALONG THE WALLS.
30-0
30 x 66 TABLE
DOUBLE GLASS (SOUND PROOF)
COUNTER FOR WEEKLY & MONTHLY MAGAZINES
LOCKERS
65-0

Layout of creative laboratory

Organizing a Class of Twenty

Teaching aids the instructor will find helpful to have:

1. Sample projects and models all made up and on display.

2. Catalogues and magazines showing variety of projects. Suggestions: *Popular Mechanics, Home Mechanics, Home Craftsman,* INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Montgomery Ward and Sears-Roebuck catalogues, manufacturers' catalogues, reference craft books on hand.

3. During the first few days after the students have selected projects their need will be for much individual attention. Help will be needed in the layout or perhaps the making of a pattern or calculating the amount of material and the cost of the material.

4. The instructor should be prepared for all of the answers wanted and should have on hand the cost of materials, size and thickness of materials, color charts and, if possible, many varied samples.

5. Whenever obtainable large wall charts showing pictures of projects or materials are very useful.

6. Visual aids of all kinds, such as: motion pictures, film strips, slides.

Integrating This Work With the Curriculum

Step one: The student selects a project, which, of course, must have value and be worth-while, and must have the approval of the instructor.

Step two: The student must make a sketch or plan of the project, compute the cost, and select the materials.

Step three: With the acceptance of the project the instructor assigns some research work that must be submitted before a grade for the handwork project can be given.

Research assignments may be submitted in writing or verbally.

Example: If the student wants to make a leather wallet, he should be informed that before his project is completed or accepted for a grade he will have to submit one, two, or more research assignments on leather. It must be some reading or information that interests him. The instructor should be very careful — here is a good place to encourage initiative and originality.

There is danger at this point that the research may be too technical and the student may lose interest. Let the student select his own research. The instructor should accept it if it is related to the materials in the project and has something about its use by people, its manufacture, and other consumer education and general education value.

Suggestions:

1. The research papers may be approved by the English teacher or the social studies teacher. If so, they take them and correct them and credit the student with the grade. There could be other co-operative schemes worked out that might be worth while.

2. The art teacher can also help, especially if the student who wants to make the project is in her art class. The design and color of the article may well be worked out in the art class.

3. There is no limit to the amount of integration that can be used if it is really wanted. If the faculty sees the value of this integration, the response to this program will be excellent.

Student Record Card and Planning Card

Planning Card

Before any work is done on the project it is necessary that some sound planning be done. The instructor must explain the planning card to the students. He should demonstrate how to process it. Herein much related subject value can be gained by the student. The instructor should not fill out the planning card for the students' projects. If it becomes necessary to help, the student should be made to provide the major part of the material and project information.

Report Card

NOTE: The report card legend cannot be easily modified by a student desiring a personal change in grade received.

Cost of Project Material

Students should pay for all materials actually used in a project. All projects should be worth while and should have value. Project material can be paid in advance or after the project has been

PLANNING MY PROJECT

A Sketch or Drawing of My Project Is on the Reverse Side

Name _____ Grade _____ I Am Making _____

Started Project — Date _____ Date Completed _____

Teacher's Final Grade _____

Materials Needed	Description and Size of Material	Cost

Remarks: Total Cost $ _____

Date Project Was Paid For _____

Research or Reading I Plan to Do About This Project _____

Teacher's Grade on Research (No. 1) _____ Research (No. 2) _____ Research (No. 3) _____

Where I Obtained My Information _____

Project planning form. Original size 8½ by 11 in.

completed. The student should, wherever possible, calculate his costs and check same with the instructor.

Collection of Money

All projects should be paid for by students.[1]

SUGGESTED REPORT CARD

CREATIVE LABORATORY REPORT CARD

Name John Doe

School Year 1946-47 Date Jan. 24, '47

Legend of Grading: ○ — Excellent; ⊖ — Average; ⊕ — Poor

	Period 1	Period 2	Period 3	Period 4	Final Grade
Ability to get along with others	○	○	⊖	○	○
Ability to mind own business	○	○	⊖	⊖	⊖
Neatness and cleanliness	⊖	⊖	○	⊖	⊖
Desire to do all work well	○	○	⊖	⊖	⊖
Willingness to work	○	○	○	○	○
Habits of promptness	⊖	○	⊖	⊖	⊖
Express thoughts clearly	⊖	⊖	○	○	⊖
Remarks:					
Project Grade of project	○	○	⊖	⊖	⊖
Remarks:					
Grades on research work submitted to instructor	⊕	⊖	⊖	⊖	⊖
Remarks:			Final Total		⊖

Instructor evaluates this grade in terms of the regular system of grades used by school.

B- Final Grade

Sample report card

When a payment is desired to be made the student should make out the receipt and the instructor should check it and sign it. The instructor can collect the project money, always making sure that he gives a receipt in return. The money can also be collected by the school bank. In this case, the student receives a receipt and the instructor receives the third copy of the receipt.

Of course, there are many other methods of making monetary collections. The above information is in the nature of a suggestion.

Equipment

The equipment list which follows is purely suggestive. If this laboratory is a place where an individual "can construct or develop any worth-while project using any medium," then the tool list and the equipment list is far from complete. However, it is possible that a laboratory can be operated with very little equipment. Good results can be accomplished with just a few hand tools. Nevertheless, the ideal laboratory is one that is as complete as possible. If funds are available and the equipment is obtainable and needed, by all means get it.

(Continued on next page)

[1]In some cases this may not be possible. Whenever a needy case arises there are several methods of getting funds. One suggestion is that he allow, whenever the project is good enough and has selling value, the student to make a duplicate which may then be sold. The selling price can be set so that it will absorb the cost of both projects. Another suggestion is that the student work overtime for the school until the cost of the project is defrayed.

REFERENCE BOOKS

Name	*Author*	*Publisher***	*Price*
Bookbinding			
Graphic Bookbinding	Louis J. Haas	Louis J. Haas	$ .50
Lost Link in the Technique of Bookbinding	P. Franck	Peter Franck	3.85
Home Bookbinding and Design	S. V. LeVine	S. V. LeVine	1.00
Commercial Art and Lettering			
Industrial Production Illustration For Students, Draftsmen and Illustrators	R. P. Hottscher	McGraw-Hill	3.50
Letters and Lettering	P. Carlyle and G. Oring	McGraw-Hill	4.00
Lettering	P. J. Lemos	Davis Press	1.00
Art in Industry	S. Cursiter	Oliver	1s.
100 Alphabets	A. R. Becker	Signs of the Times	3.00
Drawing for Life and Industry	D. Green	Bruce Pub. Co.	1.56
Cartooning and Coml. Art	E. C. Matthews and P. Albaum	World Pub. Co.	2.50
Technical Lettering (Vertical Single Stroke)	E. P. DeGarmo and Jonassen, F.	Macmillan	1.00
Handbook on Lettering	J. A. Cavanagh	Tudor	1.89
Free Hand Paper Cutter	C. Carter	McKnight & McKnight	1.00
Be Clever With Leather	V. Read	Bear	1s.6d.
Lettering Made Easy and How to Paint Signs and Showcards	E. C. Matthews	World Pub. Co.	1.98
Crafts — General			
Handy Book for Boys	J. E. Bechdolt	Longmans	1.98
Arts and Crafts	M. Ickis	Barnes	2.50
Crafts in Wartime	M. Ickis	Natl. Rec. Assn.	.35
Handicraft for Boys	Green and Jones	Religious Educ. Council of Canada	.75
Tin Can Craft	W. Dackly	Featherstone Press Ltd.	2s.6d.
Art and Materials for the Schools	S. Browne *et al*	Progressive Educ. Assn.	1.25
Low Cost Crafts for Everyone	H. A. Reynolds	Blue Ribbon Books	1.00
Creative Art Crafts	P. J. Lemos	(3.73) Davis Press	3.75
Creative Handicrafts	M. R. Hutchins	Sentinel Books	1.00
Second Book of Hundreds of Things a Girl Can Make	Musson	Musson Book Co.	1.25
Second Book of Hundreds of Things a Boy Can Make	Musson	Musson Book Co.	1.25
Handicraft of Scrap Materials	P. W. Blandford	Hutchinson	4s.6d.
W. L. Stricker's — Projects Through Crafts — Intermediate	W. L. Stricker	Humphries	1.00
Complete Book of Modern Crafts	H. A. Reynolds	Garden City Pub. Co.	1.00
Money Making Hobbies	A. F. Collins	World Pub. Co.	.49
For Love or Money	C. F. Mayer	Texas Bank Bldg. (The Author) Dallas, Tex.	1.98
Free Hand Paper Cutting	C. Carter	McKnight	1.00
Handy Book for Boys	J. E. Bechdolt	Longmans	1.98
Etching			
Etching Methods and Materials	W. Silsby	Dodd	2.50
Etching Metals and Glass	C. A. Crowley	Tech. Service	1.00
Orig. Engraving and Etching	H. E. Furst	Nelson	12.50
Formulas			
Formulary and Handbook John Hapkins Hospital	John D. Lucas Co.	John D. Lucas Co.	2.00
Henley's 20th Century Book of Formulas, Processes and Trade Secrets	G. D. Hiscox	Henley	4.00
All About Formulae	C. I. Jacobson	Focal Press	1s.6d.
Formulas for Profit	H. Bennett	World Pub. Co.	.89
Jewelry — Gems			
Conservation Jewelry Made of Waste Material	L. J. Haas	The Author	.50
Jewelry, Gem Cutting and Metalcraft	W. T. Baxter	McGraw-Hill	2.75
Jewelers' Handbook	Walter B. Frost and Co.	Walter B. Frost and Co.	.50
Gems and Gem Materials	E. H. Kraus and C. B. Slawson	McGraw-Hill	3.00
Jeweled Trail	L. Formitzer	Gold Label	1.49
Knots			
Ashley Book of Knots	C. W. Ashley	Doubleday	7.50
Practical Knots and Splices	K. E. Cahoon	U. S. Naval Inst.	.60
Knots and Splices, Manual of Useful Knots, Hitches and Splices	Geo. J. McLeod, Ltd.	Geo. J. McLeod	.30
Knots, Splices and Rope Work	A. H. Verrill	Henley	2.00
Encyclopedia of Knots and Fancy Rope Work	Graumont and Hensel	Cornell Maritime	5.00
Leather			
Be Clever with Leather	V. Read	Bear Hudson Ltd.	1s.6d.
Magic			
Magicians' Handbook	H. J. Burlingame	Wilcox and Follett	.50

***See list of publishers' addresses at end of article.

The following equipment is desired in a modern creative laboratory type industrial-arts shop that plans to meet the needs of general education. This equipment aids in allowing youth a full appreciation of manipulative, creative, and leisure-time work.

NOTE: All equipment should be small bench type, motor driven, and of 110 volt capacity. Since prices are subject to change, they have been omitted.

1 Metal turning bench lathe
1 Drill press, small bench
1 Grinder, metal, bench type
1 Buffing and polishing machine
1 Bench band saw
1 Complete lapidary cutoff machine
1 Complete lapidary grinder with No. 80 and No. 160 grit wheels
1 Scratch sanding — drum sanding machine
1 Bench jig saw
1 Complete lapidary buffing machine with 2-in. face felt buffing wheels
1 Complete metal-cutting band saw with 1/8- and 1/4-in. metal blades
1 Hand printing machine and type
1 Victor movie machine and a 3 by 5 ft. bead screen
1 Complete set of photography equipment including trays, enlarger, developing tanks, etc.
1 Complete set of bookbinding equipment
1 Complete wood and metal spinning lathe with all tools
2 Complete foot looms (weaving), shuttles, etc.
1 Foot or power leather-sewing machine
1 Foot or power cloth-sewing machine
Miscellaneous hand tools
Reference books

Essential Hand Tools for Art Metalwork

Blow pipe
Borax slate
Brush, art and lettering
Buffing wheel
Burnisher
Chasing tools, set
Tile, needle, set
Form, bending jig
Form, tray and plate
Frame, coping saw
Frame, jewelers saw
Hammer, chasing
Hammer, planishing
Hammer, raising and bumping
Hammer, silversmith's
Jar, stone, etching
Knife, Sloyd, 3½ in.
Mallet, assorted shapes
Modeling tools
Pan, copper, acid and pickling
Ring sizes
Sand bag
Stake, anvil head, assorted shapes
Stake, arts and crafts — bending, forming, and planishing
Tweezers
Wire, scratch wheel, 6 in.

Hand Tools for Bookbinding

Clamp, backing
Clamp, sewing
Cutter, paper or millboard
Frame, sewing
Press, book

(Continued on next page)

Name	*Author*	*Publisher*	*Price*
Marionettes			
Marionettes At Home	C. S. Forester	Saunders	1.25
Puppetry for School and Home	H. W. Whanslaw	Nelson	1.00
Hand Puppets and String Puppets	W. S. Lanchester	Manual Arts	.75
Model Theatre and Puppet Making	C. and E. Holst	Vawser and Wiles, Ltd.	2s.
Metalwork			
Elements of Practical Sheet Metal Work	D. Graham	Sheet Metal Worker	1.00
New Methods for Sheet Metal Work	W. Cookson	Sheet Metal Worker	2.00
Metals and Alloys Dictionary	Merlub-Sobel	Chemical Pub. Co.	4.50
1000 Questions and Answers for Practical Engineers	P. W. Blandford	Hutchinson	2s.
Boys Book of Metalcraft	W. A. Bagley	Vawser and Wiles	3s.6d.
Metal Forming by Flexible Tools	Frey and Kogut	Pitman	3.00
Materials and Processes	J. F. Young	Wiley	5.00
Sheet Metal Theory and Practice	J. C. Butler	Wiley	3.00
Elements of Practical Sheet Metal Work	D. A. Graham	Sheet Metal Worker	1.00
New Methods for Sheet Metal Work	W. Cookson	Sheet Metal Worker	2.00
Basic Bench Metal Practice and Precision Measuring	Giachino and Feirer	Manual Arts	2.75
Fundamentals of Shop Work	W. H. Johnson and L. V. Newkirk	Macmillan	1.32
Sheet Metal Pattern Layouts	E. P. Anderson	Audel	4.00
Simplified Methods in Sheet Metal Layout	H. B. Reid	Goodheart-Willcox	3.00
Sheet Metal Workers Handbook	J. P. Harmer	Sheet Metal Worker	1.50
Practical Sheet and Plate Metal Work	E. A. Atkins	Pitman	3.40
Practical Outline of Mechanical Trades for Home Study	W. L. Schaaf	Garden City Pub. Co.	3.95
Fundamentals of Shop Work	W. H. Johnson and L. V. Newkirk	Macmillan	2.00
Modern Metalsmith	L. A. Voss	Sheet Metal Worker	4.00
Minerals			
Minerals and Rocks	R. D. George	Appleton-Century	6.00
Model Planes			
Model Plane Annual	D. C. Cooke and J. Davidson	McBride	2.50
Modeling			
Ceramic Data Book (Annual)	Industrial Pub.	Industrial Pub.	1.00
Fun With Clay	J. Leeming	Lippincott	2.00
Modeling For Amateurs	C. and R. Ellis	Studio	1.00
Boat Building			
Boat Building Simplified	H. J. Ashcroft	Watts	5s.
40 Designs for Post War Boats	W. Atkin *et al*	Motor Boating	3.00
Sailboat Plan Book	The Rudder (periodical)	Rudder Pub. Co.	2.00
Plywood Boat Plan Book	The Rudder (periodical)	Rudder Pub. Co.	.50
Painting			
Oil Painting for the Beginner	F. Taules	Watson-Guptill Pub. Co.	6.00
Making a Water Color	G. P. Ennis	Studio	3.50
Direct Technique of Water Color Painting	E. Carlson	House of Little Books	1.00
Teacher of Water Color Painting	D. M. Campana	Campana	1.00
Paint Brush Fun For Home Decoration	J. A. Ornstein	Greenberg	2.50
Home Craft Course in Pennsylvania German Painted Tin	E. S. Hake	Mrs. C. N. Keyser, Plymouth Meeting, 1, Pa.	1.00
Photography			
Retouching and Finishing for Photographers	Adamson, J. S.	Pitman	2.25
Better Photography Made Easy	Agfa Ansco	Agfa Ansco	.25
Guide to the Literature of Photography and Related Subjects	Boni, A. Comp	Morgan and Lester	1.00
Fundamentals of Photography	P. E. Boucher	Van Nostrand	3.00
Crazy Camera	C. A. Bromley	Focal Press	6s.
All About Better Prints for Your Darkroom	F. W. Frerk	Transatlantic	.50
All About Making Enlargements in Your Dark Room	C. I. Jacobson	Transatlantic	.50
Enlarging	C. I. Jacobson and P. C. Smethurst	Brooks	2.25
Home Made Papers, Films and Plates	C. I. Jacobson	Transatlantic	.75
Photographic Enlarging	F. I. Jordon	Am. Photographic Pub.	3.50
On Photographic Enlarging and Print Quality	J. G. Lootens	Camera	3.50
All About Tracing Troubles in Your Photographs	A. Merryweather	Transatlantic	.50
Neblette's Elem. Photography for Club and Home Use	C. B. Neblette	Macmillan	1.00
Modern Enlarging Technique	H. Neumann	Brooks, Burleigh	.60
Better Snapshots With Any Camera	E. Smith	Transatlantic	.50
All the Photo Tricks	E. Smith	Focal Press	10s.6d.
Photography for Fun	W. M. Strong	Sentinel Books	1.00
All About Daylight Indoors and Your Camera (New Edition)	H. V. Wadenoyen	Transatlantic	.50
Making An Enlarger	H. V. Wadenoyen	Focal Press	3s.6d.

Pressing board
Awl, scratch
Back saw
Backing hammer
Clamp, hand screw
Drill, hand, ¼-in. cap.
Drills, 1/16 in. and ⅛ in.
Knife, bookbinders
Needles, lacing and sewing
Pliers, flat nose
Punch, leather
Sponge
Square, steel 1 ft.
Stylus, electric
Type, Art Gothic, 18 pt., brass

Hand Tools and Materials for Jewelry Work

Alcohol lamp
Blowtorch
Borax
Silver solder
Bezel burnishing tool
Ring mandrel
Ring size gauge
Needle files
2 4-in. pliers, parallel jaw type
2 4-in. diagonal pliers
2 doz. jewelers coping saw blades
Assorted files, 4 and 6 in. in length
6 charcoal blocks for soldering
1 small coil of soft iron wire
1 quart sulphuric acid
1 jar for pickling
1 dozen fire bricks
6 small brushes for handling borax
2 small bench swivel vises
1 pair 6-in. snips
1 pair 10-in. snips
2 hand vises
1 set of drills, No. 80 to No. 1
2 sticks of jewelers rouge for polishing
1 small jewelers buffing outfit complete with buffs

Tools and Equipment for Leathercraft

2 Spoon modelers
2 Tracers or scribers
1 Edge creaser
2 Mallets
1 Spring punch
1 Set of drive punches
2 Skinning knives
1 Snap button fastener
1 12-in. steel square
1 Can saddlesoap
1 Can rubber cement
1 Eyelet setter

Hand Tools and Materials for Lapidary Work

Assorted lengths of hardwood dowels, sizes ⅛, ¼, ⅜, 7/16, ½ in. for making dope sticks
1 Alcohol lamp
12 sticks of jewelers wax
1 lb. can of tin oxide
1 lb. can of zinc oxide
1 lb. can of 160 grit abrasive
1 lb. can of FF grit abrasive
1 doz. sheets of coarse wet or dry abrasive paper
1 doz. sheets of 120 grit wet or dry abrasive paper
1 doz. sheets of 220 grit wet or dry abrasive paper
1 doz. sheets of 400 grit wet or dry abrasive paper

(Continued on next page)

Name	*Author*	*Publisher*	*Price*
Plastics			
Plastics Simplified	D. W. Brown	Pitman	.60
General Plastics	R. Cherry	Grosset	1.50
Plastic Working of Metals and Non-Metallic Materials in Presses	E. V. Vrane	Wiley	5.00
Laboratory Manual of Plastics and Synthetic Resins	G. F. D'Alelio	Wiley	2.00
Plastic Molding	Dearle, D. A.	Chemical Pub. Co.	4.00
Plastics	J. H. DuBois	Am. Tech. Soc.	3.75
Plastics in the World of Tomorrow	B. W. Leyson	Dutton	2.50
Plastics, Problems and Processes	D. E. Mansperger and C. W. Pepper	Int. Textbook	3.00
Industrial Plastics	H. R. Simonds	Pitman	5.00
Handbook of Plastics	H. R. Simonds and C. Ellis	Van Nostrand	10.00
Plastics Catalog	Plastics Catalogue Corp.	Plastics Catalogue Corp. 1945	6.00
Printing			
Printing for the Schools	C. W. Hague	Bruce Pub. Co.	2.50
Printing Shop Math.	H. D. Harper	Van Nostrand	1.50
Printing for the Beginning Pupil	J. W. Loop	The Author	2.00
Junior Printing	C. K. Lush	Manual Arts	.68
Printing Explained	H. Simon and H. Carter	Transatlantic	2.50
Children's Work in Block Printing	R. Tanner	Manual Arts, 1942	1.75
Puzzles			
Children's Puzzle Book	M. Adams	Transatlantic	.75
Dr. Quizzler's Mind-Teasers	Cutler, J. H.	Greenberg	1.00
100 Puzzles	Filipiak, A. S.	Barnes	1.00
Riddle-de-quis	H. S. Fisher	Mill	2.00
Everybody's Puzzle and Problem Book	O. Katzin	Vawser and Wiles	2s.
Recipes			
200 Dishes for Men to Cook	A. H. Cente	Barrows	2.00
Good Housekeeping Cook Book	Good Housekeeping Institute	Fan.	2.75
World Wide Cook Book	P. Metzelthin	Tudor	1.98
Nutrition with Sense	E. Sense	Barrows	2.00
Kitchen Cabinet Recipes, (3 vols.)	Sunset Magazine	Lane Pub. Co.	ea. 1.00
Recipes of the United Nations	I. Veal	Gifford	5s.
Food for the Family (Second Edition Rev.)	J. S. Wilmot and M. Q. Batjer	Lippincott	3.25
Working Girl Must Eat	H. Young	Little	2.00
Recreation — Miscellaneous			
Arts and Crafts for the Recreational Leader	National Rec. Assn.	Natl. Rec. Assn.	1.50
Stamp Collecting			
Philatelic Terminology	Chambers Pub. Co.	Chambers Pub. Co.	.25
U. S. Postage Stamps of the 20th Century	M. G. Johl	Lindquist	3.50
Reference Album of Philatelic Terms	Lindquist	Lindquist	.15
Highway Into Stamp Collecting	S. G. Rich	Chambers Pub. Co.	.50
Standard Postage Stamp Catalogue	Scott Pub.	Scott Pub.	2.50
Catalogue of U. S. Stamps Specialised, 1944	Scott Pub.	Scott Pub.	3.00
Commemorative Stamps of the World	P. H. Thorp	Lindquist	.98
Stamp Collecting, Why and How	P. H. Thorp	Lindquist	.69
Toys			
Making Nursery Toys	N. Catford	Muller	3s.6d.
Paper Toys for the Classroom	E. Dorsey and R. Anderson	School Aids	1.35
Toy-Making	M. Early	Studio	3.50
Making of Soft Toys	C. E. Edlmann	Manual Arts	1.00
Toys Children Like	A. M. Ewen	Assn. for Childhood Educ.	.20
How to Make Strong Wooden Toys	C. H. Hayward	Evans	3s.
Toys: Their Design and Construction	J. Kay and C. White	Univ. of London Press	9s.6d.
Dressed Soft Toys	E. Moody	Manual Arts	.95
You Can Make It	Newkirk and Zutter	Silver	3.00
Toy Making for Children	Crowther	Crowther	1s.3d.
Toys You Can Make of Wood	L. Turpin	Greenberg	2.50
Weaving			
Handweaver's Pattern Book	M. P. Davison	Swarthmore Looms, Box 299, Swarthmore, Pa.	6.50
Home Craft Course in Pennsylvania Dutch Homeweaving Patterns	M. P. Davison	Mrs. C. N. Keyser, Plymouth Meeting 1, Pa.	1.00
Hand Weaving and Educ.	E. M. P. Mairet	Transatlantic	1.50
Weaving and Other Pleasant Occupations	R. K. and M. I. R. Polkinghorne	Bridgman	3.00
Weaving Patterns of Yesterday and Today	V. Thurston	Manual Arts Press	1.15
Woodwork, Wood Carving, Whittling, Etc.			
Woodworking Projects for Industrial Arts Students	G. Baysinger and H. Schaal	McGraw-Hill	1.40
Teacher of Casting, Modeling, Sculpture,			

1 14-in. diamond lapidary cutoff wheel
1 8-in. diamond lapidary cutoff wheel
5 gal. stove oil or kerosene
1 gal. lubricating oil

Equipment for Pottery Work

1 Potter's wheel
1 Damp box
1 Mesh screen
4 Earthenware crocks, 1- and 2-gal. sizes
2 Enamel basins
Miscellaneous sizes of plaster bats
Drying basin
Diversified modeling tools
1 wedging board
Supply of miscellaneous jars and rags

Weaving Equipment

1 Warping board
1 Skein winder
1 Spool rack
12 Miscellaneous shuttles
3 Sleighing hooks
Extra heddles

Movie Films

Suggestions on the use of visual aids in the creative laboratory or handcraft shop.

1. All students should be taught to operate the movie machine — set it up and show the film, wind and unwind films, and repair film.

2. Sometime before a student completes his project he must select a film, set up the movie machine, see the movie, and give either a verbal report on what he saw before a group of interested students, or submit a written report to the instructor. This, too, can be integrated with the social studies subjects or the English subjects.

3. Students should be taught how to order films. They can submit the order to the instructor who then checks on its validity and its tie-in with the work the student is doing.

NAMES OF FIRMS THAT DISTRIBUTE FILMS AND VISUAL-AID INFORMATION

Castle Film Co., RCA Building, Rockefeller Center, New York City
Eastman Kodak Co., Teaching Films Division, Rochester, N. Y.
Films of Commerce Co., 21 West 46th St., New York City
Bell and Howell Co., 716 N. La Brea Ave., Hollywood, Calif.
Erpi Classroom Films, 1841 Broadway, New York City
Jam Handy Co., 1775 Broadway, New York City
Educational Film Catalog, H. W. Wilson Co., New York City

Books for the Creative Laboratory Reference Library

Reference Books

All books must be stamped by the librarian. Books can be loaned out to a student for one night. A longer period of time can be granted if the instructor approves. Books must not be issued out to a student before the last period of the school day. Books must be returned before the first period of the school day.

This service can be worked out with the school librarian. Primarily, reference books are a definite part of the creative laboratory and should be at all times on the reference shelves for the use of the students.

Name	*Author*	*Publisher*	*Price*
Wood Carving, Pottery	D. M. Campana	Campana	1.00
500 More Things to Make for Farm and Home	G. C. Cook	Interstate	3.00
Let's Build	C. H. Crocker	Houghton	1.50
Wood Rasp Carving	L. J. Haas	The Author	.80
New Woodwork From Old	C. H. Hayward	Evans	3s.
Home Hobbies in Wood	C. H. Hayward	Evans	3s.
Fun With Wood	J. Leeming	Stokes	2.25
It's Fun to Make It Yourself	S. Maney	Garden City Pub. Co.	2.95
Woodcuts and Wood Engravings	N. Rooke	Stevens and Brown	6s.
Woodworking for Everybody	J. Shea and P. Wenger	Int. Textbook	2.00
101 Home Furnishings & How To Make Them	L. S. Wakefield	Harper	2.50

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American Technical Society, 850 E. 58th St., Chicago, Ill.
American Photographic Pub. Co., 353 Newbury Street, Boston, Mass.
D. Appleton-Century Co., Inc., 35 W. 32nd St., New York City.
Assn. for Childhood Education, Room 391, 1201 16th St. NW, Washington, D. C.
Theo. Audel and Co., 49 W. 23 St., New York City.
A. S. Barnes and Co., 67 W. 44th St., New York City.
M. Barrows and Co., 443 4th Avenue, New York City.
Bear, Hudson, Ltd., Hudson House, 63 Goldhawk Rd., London, W. 12.
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Fan Memorial Inst. of Biology, Peiping, China.
Featherstone Press, Ltd., Guardian House, Forest Rd., Walthamstow, London, E. 17.
Focal Press, Ltd., 31 Fitzroy Sq., London, W. 1.
Franck, Peter, Gaylordsville, Conn.
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Garden City Publishing Co., Inc., Garden City, New York City.
John Gifford, Ltd., 113 Charing Cross Rd., London WC 2.
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The Goodheart-Willcox Co., Inc., 2009 S. Michigan Avenue, Chicago 16, Ill.
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Harper and Brothers, 49 East 33rd St., New York City.
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Houghton Mifflin Co., 2 Park St., Boston 7, Mass.
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Industrial Publications, Inc., 59 E. Van Buren St., Chicago, Ill.
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The Interstate, 19–23 N. Jackson St., Danville, Ill.
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Little, Brown and Co., 34 Beacon St., Boston, Mass.
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Plastics Catalog Corp., 122 E. 42nd St., New York 17, N. Y.
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Religious Education Council of Canada, Supply Depot, Rm. 417, 299 Queen St. W., Toronto, 2, Canada.
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W. B. Saunders Co., 218 W. Washington Square, Philadelphia, Pa.
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Technical Service Publishing Co., 6805 N. Clark St., Chicago, Ill.
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Organization of Related Instructional Materials for Apprentices

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In preparation for preparing an article on the organization of related instructional material for apprentice training, I have attempted to look back upon my experiences with apprentice training committees in better than thirty specific trades and occupations.

Chicago Program

The apprentice training program in Chicago has been in operation in some trades for over 25 years. Philip L. McNamee, assistant superintendent of schools in charge of vocational education, has worked with organized labor groups as assistant superintendent and industrial co-ordinator for the Chicago board of education for over twenty years, and has produced a program of which Chicago may well be proud. It should be remembered that a number of national programs have been patterned upon Chicago's accomplishments, but it is of more importance that the apprentices and tradesmen have benefitted by the training in which both industry and the schools have played a part.

The purpose of this article is to present a procedure for the derivation of related instruction materials used in the apprentice training program.

Definition of Terms

In discussing the organization of related instructional material, it is well to begin with definitions of the terms involved. By "organization" one might mean the preliminary or tentative program outline agreed upon previous to the opening of a class. In this article, however, we will use the foregoing phrase as meaning the formulation of the final individual instruction sheet which allows the apprentice to progress according to his own background and ability.

The term *related instruction* means that portion of the training which can best be cared for in the school. It is that which supplements the information and skill acquired on the job. Many occupations require not only classroom instruction but also some shop instruction in the development of hand skills. There has been considerable opposition to the inclusion of shopwork in the schools as a part of related instruction for apprentice training.

Within the past ninety days, four new apprentice groups have been added to the Washburne Evening School program. They were inducted into the evening school because there is now not sufficient space to care for them in the day school. Most of our programs are daytime programs. These four groups are: cement finishing; tile laying; switchboard construction mechanics on light and power switchboards; and die sinkers. Of these four groups, three of the apprentice committees requested shopwork.

Shop Work Demanded

The switchboard group was the only one deciding upon classwork only. The cement finishers and tile layers provided space outside the school for the practical instruction. The die sinkers requested the use of a machine shop one night per week, i.e., for one half of the school time.

If we meet the demands made upon us by the apprentice committees, we have no choice but to offer shop courses as a part of the related instruction given in the school.

This question needs special consideration because there are certain national standards that are being formulated. It is necessary, therefore, to go on record as questioning the advisability of too limited a definition of related instruction when considering the part to be carried on in the school. It has been our experience that some related occupational shop training must be included in *related instruction* given in the school. For example, the patternmaking committee has established a program starting with foundry work. The apprentice spends one third of his eight-hour school day in the foundry for one and one-half years. The railroad apprentices all take up welding. Many other examples could be cited.

Related Shop Instruction

Related instruction, therefore, may be thought of as including both related shop instruction as well as related occupational shop instruction.

Who Should Determine the Related Instruction to Be Given?

One might look to the school, the employer, or the employee. Although we have a vocational curriculum department now in operation for the past six years, and have gained considerable experience and accumulated many courses which provide us with examples, no attempt is made to determine a program of instruction for an apprentice group without calling for an apprentice committee. From experience we have learned that though we may have prepared, and are using successfully, an instructional program for an occupation,

another group from another plant in that same occupation needs special consideration. To gain insight into these special needs we call for an apprentice committee representing even one small plant.

Upon What Should the Related Instruction Be Based?

In reviewing the procedure followed in the formulation of a program, it is necessary that consideration be given to the basis from which the related instruction may be drawn. There is in reality only one source from which we may determine the related instruction needed by apprentices of an occupation. That source is the demands of that occupation. However, our job goes further than determining occupational demands. We must consider the total needs of the occupation, determine that portion which can be cared for on the job, the possibilities for covering the balance in the school, and then organize the school end of the work according to the individual abilities of the apprentices involved in the particular program.

Responsibility of Employer and Employee Groups

Wherever an apprentice program exists or is being established, it is essential that the employer and members of the employee group also realize their responsibility for assisting in the training. Without this assitance the school faces an almost impossible job.

With this understanding it is possible to relieve the school of full responsibility of the related instruction, leaving a portion to on-the-job training personnel.

How Should the Instructional Material Be Determined?

If the question, "How should instructional material be determined?" had been asked five years ago, the writer would have answered immediately "job analysis." Searching through recent state plans shows that 28 states list job and/or trade analysis; 14 construction of vocational curriculum; 9 instruction sheet preparation; 3 organization of content for trade classes as required vocational teacher training courses. This indicates that job analysis is still considered of great importance.

A second procedure which may be used is type job analysis. A third procedure is observation of what a worker does. However, when faced with the introduction of a number of apprentice programs within a few days' time (as happened last year with the influx of G.I.'s) and to be assisted by untrained teachers, there just isn't time for making a complete analysis of an occupation.

Trade Analysis Now a Teacher Training Procedure

One also finds that analyses made even a few years ago have become obsolete. It was necessary to pass up this procedure. In fact, I believe we in the vocational training field have reached a point in our thinking which places job analysis as a teacher-training procedure, rather than as the most effective procedure for determining the beginning program. The factor which limits the procedure selected for doing the job is the time that training can be delayed.

Federal Committee on Apprentice Training

During the past few years the Federal Committee on Apprentice Training under the direction of William Patterson has been developed, and vocational education now depends upon this organization to do many things toward the establishment of the training program.

When the organization of the apprentice training has progressed to the point where school attendance is being considered, there has already been organized an apprentice committee which consists of representatives of the employer, of the employer group, representatives of the employee group, and the particular agent of the apprentice training committee. The person from the apprentice training committee at this time calls the vocational office and asks for consideration of the inclusion of the particular group in the vocational school program.

How Vocational Staff Functions

On the supervisory staff there is a person designated as apprentice supervisor. This person is assigned to care for the establishment of the requested program in the school and automatically becomes a member of the apprentice committee. He arranges for a meeting of the committee at Mr. McNamee's office or at the school. This is important in that schoolmen acting as host to the group can hold the work of the committee during these sessions to a consideration of school matters.

If the program is to be in the day school, the director of the day school attends; if evening school, the evening school director attends. The supervisor of curriculum is placed in a position of being the person waited upon by the committee. At this time the committee has reached a point where they are seeking help.

We have found that by allowing a short time to elapse, that is, from a week to ten days, and through the urging of the agent of the Federal Committee on Apprentice Training, that members of the committee give some thought to curriculum, the committee is conditioned. Some committees come to our first meeting with a tentative program for the training of their apprentices.

The First Meeting on Curriculum

Before the committee meets an attempt is made to become familiar with their field. When preparing to work with the cement finishers, a full day's time was spent in the library gathering information dealing with cement, concrete, mixtures, and other items related to the occupation. A number of books were brought to the curriculum room to be available for the meeting. This step has been found to be of great importance in that the committee is usually impressed with the attention given the preparation. Usually the committee learns of new materials in their particular field.

The first meeting of the committee with the schoolmen offers an opportunity to become acquainted. It has been found that usually the committee has dwindled in size, as often members are a little leery of the part they are to play. Some fear exposure of their lack of knowledge. Often new

Lane Technical High School, Chicago, Ill., machine shop. Photograph submitted by Dr. Louis V. Newkirk, Director of Bureau of Industrial Arts

members, who are especially interested in the schooling, are added to the committee. The vocational teacher or administrator having an opportunity to work with the apprentice committees is extremely fortunate.

Each member of the committee has an opportunity to present what he considers essential to the training of the apprentices. Careful notes are made. Literature on the subject and related fields is placed before the committee. Often it is possible to select from other apprentice courses phases of already organized materials which appear to be what is needed. From the opinions gathered, a brief summary is made and everyone urged to give further consideration to the training program. The time is set for the next meeting, usually within a week or ten days.

Work Done Between Meetings

Between these two meetings a tentative course is formulated, often by working with some member of the committee who is especially interested. In some instances a member of the committee may be considered as a candidate to teach the subject. The opinion of the committee is always asked. If a candidate for the position of teacher is found, his papers are completed and sent for approval, and he is used on the curriculum work when available. Recently three organizations have paid up to four weeks' time for a member of the craft to work on the organization of instructional material.

Other groups, such as the light and power switchboard workers, determine, by listing needs, upon a more academically trained teacher. This particular group requested an elementary review of electrical physics.

The Second Meeting

At the second meeting of the committee a tentative itemized program is presented, class sessions determined, and the work to be accomplished is given consideration. From this meeting there usually comes an agreement upon the beginning program. School space — classroom or shop — is considered, and often the space available for use is visited. Arrangements are made and a time is set for the class to register.

The class reports at the designated time and begins to function according to the tentative plans. The instructor is assisted in securing materials to work with and text materials to tide him over until the apprentices can secure books. In some cases where the program is experimental, books are provided from the school library until a more permanent decision is reached.

New Program Carefully Observed

A close watch is kept on each new program. Recognition is made of many factors. The instructor may never have taught before; apprentices' backgrounds are varied; the real needs of the trade may have been missed and the materials suggested for beginning the program may not be as closely related as appeared at the time of selection.

After four to six class sessions, assistance is given in formulating examinations covering the materials presented. From this examination a picture is drawn of each apprentice's ability and, as well, the effectiveness of the instruction.

Every Instructor Encouraged

During this time, however, curriculum work has not stood still. Each new instructor is encouraged to put on paper that which he thinks should be taught. Each is encouraged to gather materials from his trade. Curriculum work begins where the teacher's ability and background permit, and progresses accordingly. Some new instructors have the ability to visualize their entire occupation, and others need guidance in going from one element to another.

That which must be kept in mind is that we have apprentices to teach. The class sessions follow with a regularity that sometimes makes a teacher feel he is on a treadmill. The attitude with which we approach each new group of apprentices is that this beginning class is the first of a long succession of such classes, each of which, we hope, to do a better job.

From this procedure we may have, if we are fortunate, a fairly complete course outline, as is the case with the automobile mechanics outline. Having this outline one might think we could merely turn to Kuns's books or to Heitner's text for the individual instruction. We have found these texts extremely useful. Our program would not function as well without some of the excellent text materials available. However, consideration has to be made to school facilities and some specific things for the learner to do. For this purpose the instructor is encouraged and assisted in setting up short units of instructional materials.

Facilities are available so that the instructor is encouraged to present copy in longhand with sketches or pictures from literature of the trade. Copy is typed, edited, sketches made, and returned to the instructor for approval before being duplicated.

With this procedure, individual sheets grow into units which may eventually result in complete units of a fairly permanent nature.

There is no thought given to the writing or publishing of completed textbooks. We are concerned with the meeting of our own needs. We must admit that it is almost a day-by-day meeting of needs at present. However, instructors of our vocational schools have formulated texts which have been published as a result of the procedure I have presented. Our instructors are encouraged to do so.

As the curriculum work progresses, an attempt has been made to utilize the schooltime to greatest advantage. Particular attention has been given to the determination of previous educational experiences which apply on the apprentice course. For example, test sheets have been organized in drafting and a series of completion plates comparable to the work covered in two years of high school mechanical drafting which not only act as a power test but provide instructional material for review of fundamentals.

The economy of schooltime may be illustrated by the special attention given the teaching of drafting to pipe fitter apprentices. Realizing that the purpose of the training was not to make draftsmen but to develop the ability to use plans in laying out work and the reading of them when working on the installation of equipment special completion plates have been organized which save as much as 80 per cent of the schooltime previously given to this unit of work.

The effectiveness of color has also been considered. Through various means of duplicating, it has been found possible to increase the value of individual instruction sheets and also wallcharts.

From the foregoing, the importance of having specially trained curriculum workers available to assist your instructors in the preparation of materials becomes quite plain.

WINTER TIPS FOR DRIVERS

1. *Maintain Visibility.* You must see a hazard to avoid it. Check windshield defroster wiper, headlights, and keep windshield clean.

2. *Reduce Speeds According To Snow and Ice Conditions.* Remember, it takes 3 to 11 times as far to stop on snow or ice as on dry pavement, unless you have on tire chains.

3. *Keep Safe Distance From Vehicle Ahead.* When roads are slippery allow 3 to 6 car lengths for every 10 m.p.h. because snow and ice increase braking distances 3 to 11 times. Slipperiness on ice varies, glare ice at thawing temperatures being twice as slippery as dry ice near zero.

4. *Put On Anti-Skid Chains When Snow or Ice Prevail.* Tire chains reduce braking distances 40 to 50 per cent, and provide needed *go* traction on snow or ice.

5. *Practice Defensive Driving.* This means driving so that you are prepared for any emergency under prevailing conditions. Anticipate mistakes of pedestrians and other drivers.

6. *Signal Intentions Clearly As Possible.* When turning or stopping remember others may be unable to do likewise as quickly as normal on hard-packed snow or ice, if they have neglected chains.

(*International Assn. of Chiefs of Police*)

How many homes are there in your community? Last year of every 1100 homes, one was visited by death due to home accidents.

Vocational Guidance Research in the Industrial-Arts Laboratory

ISADORE M. FENN
Chicago Vocational School
Chicago, Ill.

A study of one hundred students in the technical department of a typical Chicago academic high school, ages ranging from thirteen to eighteen years.

This study was conducted by the questionnaire method, and the students were asked to answer the following questions:

1. What is your age?
2. What career do you intend to prepare for and enter?
3. What influenced your choice?
4. What college do you intend to enter?
5. What is your hobby?
6. What is your father's occupation?

The following information was obtained from the school's records:

1. Student's I.Q.
2. Student's marks in industrial arts, mechanical drawing, English, general science, and algebra.

Although this study was made for the purpose of determining the following items, other items of information were also discovered:

1. The percentage of students choosing the same occupation as their father's.
2. The percentage of students who received *E* or better in this technical sequence and the percentage of these students who have chosen a career other than technical.
3. The comparison of the student's I.Q. and the grades in his school work.
4. The percentage of students not going to college.
5. The percentage of students who were guided in their choice of careers.

The results follow:

1. 11 per cent of the students chose same occupation as father.
2. 12 per cent of the students receiving *E* or better chose careers other than technical.
3. 43 per cent received *E* or better in industrial arts.
4. 21 per cent received *E* or better in mechanical drawing.
5. 15 per cent received *E* or better in English.
6. 25 per cent received *E* or better in general science.
7. 20 per cent received *E* or better in algebra.
8. 1 per cent failed in industrial arts.
9. 5 per cent failed in mechanical drawing.
10. 37 per cent not going to college.
11. 6 per cent chose a career which requires college training but have designated no college.
12. 51 per cent were not influenced or guided in their chosen career.
13. 43 various careers were chosen by the 100 students.
14. 45 occupations represented by the fathers.
15. 14 per cent of the students chose the career of aviator.
16. 10 per cent of fathers are automobile mechanics.
17. 18 per cent are salesmen.
18. 9 per cent are tailors.
19. 1 student with 85 I.Q. received *D* in industrial arts.
20. 20 students with I.Q. 84 to 127 received *F* in industrial arts.
21. 36 students with I.Q. 80 to 148 received *G* in industrial arts.
22. 28 students with I.Q. 82 to 134 received *E* in industrial arts.
23. 15 students with I.Q. 82 to 190 received *S* in industrial arts.

This study definitely shows that the students received very little guidance in their selection of a life work. One can readily see, in examining this study, that there is a very important need for vocational guidance. This study suggests an interesting field for research on the part of industrial-arts laboratory teachers.

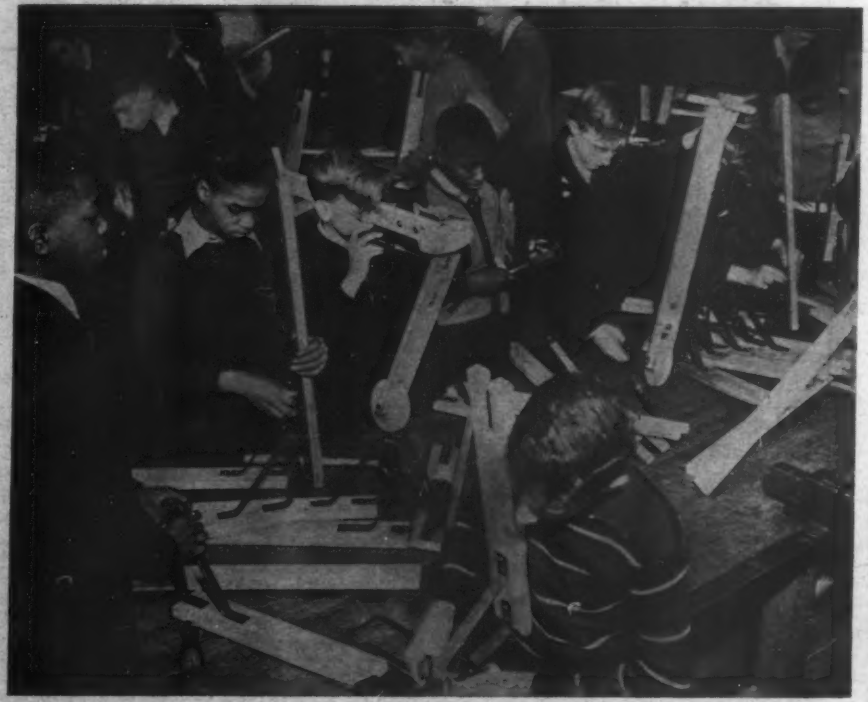
Code of Grades

S — Superior — 95–100 inc.
E — Excellent — 88–94
G — Good — 81–87
F — Fair — 75–80
D — Failure

Father's Occupations Chosen by Students

Number of Students	*Occupations Similar to Father's*
1	Dentist
2	Electrician
1	Engineer (mechanical)
1	Furrier
1	Glass Cutter
1	Machinist
1	Mailman
2	Mechanic (auto)
1	Photographer

(Continued on page 118. See also tabulation on pages 116 and 117)



Industrial-arts laboratory, Chicago Public Schools. Dr. Louis V. Newkirk, Director, Bureau of Industrial Arts

AGES, I.Qs., GRADES, AND PERSONAL DATA

One Hundred First Semester Technical High School Students

Student No.	Age	I.Q.	Grades					Career Chosen by Student	Who Influenced Choice	Prospective College or University	Hobby	Father's Occupation
			Industrial Arts	Mechanical Drawing	English	General Science	Algebra					
1	15	105	G	G	F	G	E	Aviator	Father	Armour Tech	Aero Models	Printer
2	15	100	S	E	G	G	F	Engineer	Teacher	Armour Tech	Collect Coins	Tailor
3	14	112	G	F	G	F	D	Furniture Salesman	Parents	Northwestern University	Musician (Drum)	Upholsterer
4	14–5	117	E	G	G	G	G	Electrician	Uncle in Field	No	Swim	Egg Candler
5	15	105	E	G	G	F	G	Electrical Engineer	Nobody	Armour	Collect Stamps	Pharmacist
6	16	90	F	D	D	F	F	Furrier	Father	No	Football	Furrier
7	14	97	G	E	F	E	E	Mechanical Engineer	Nobody	Northwestern University	Stamps	Physician
8	14–6	108	G	F	E	D	G	Aviator	Father	No	Aero Models	Auto Mechanic
9	14–6	97	E	F	G	G	F	Journalist	Nobody	University of Chicago	Photography	Salesman
10	15	84	S	S	F	G	G	Aeroplane Mechanic	Nobody	Aero Training School	Aero Models	Printer
11	15–5	90	S	E	E	E	F	Aeronautical Engineer	Nobody	Aero Training School	Aero Models	Tailor
12	14	116	G	F	E	E	D	Auto Mechanic	Nobody	No	Sports	Salesman (Hardware)
13	16	132	E	G	F	F	E	Furrier	Works in Fur Shop	North Park College	Collect Knives	Auto Mechanic
14	16–6	88	F	D	D	F	D	Radio Mechanic	Teacher	No	Swim	Salesman (Auto)
15	15	100	F	G	F	F	F	Electrical Engineer	Nobody	No	Football	Salesman
16	15	89	G	G	F	G	F	Newspaper Reporter	Friend in Field	Northwestern University	Collect R.R. Stickers	Barber
17	15	122	G	G	D	G	F	Photographer	Nobody	No	Photography	Photographer
18	15–5	99	E	G	G	F	G	Illustrator	Uncle in Field	Art Institute	Collect Comic Strips	Tailor
19	14–6	97	E	G	F	G	E	Electrician	Mother	No	Aero Models	Electrician
20	15	102	E	G	G	E	E	Lawyer	Brother	Northwestern University	Home Workshop	Salesman
21	15–6	100	E	S	F	F	G	Mailman	Uncle	No	Collect Coins	Mailman
22	15	90	E	F	F	G	F	Aviator	Nobody	Aero Training School	Collect Stamps	Salesman
23	16	95	F	F	F	F	F	Auto Mechanic	Nobody	No	Models	Tailor
24	15–4	108	S	E	E	S	E	Architect	Father	Armour Tech	Aero Models	Auto Mechanic
25	14–6	103	G	G	E	G	G	Streetcar Motorman	Father	University of Notre Dame	Wood Carving	Carpenter
26	17–6	80	G	F	D	F	D	Electrician	Nobody	No	Ice-Skating	Electrician
27	14	148	G	G	E	E	S	Industrial Chemist	Father	Northwestern University	Stamp Collecting	Salesman (Insurance)
28	15	82	G	F	F	G	F	Aviator	Nobody	Aero Training School	Photography	Salesman (Gas Station)
29	14	101	E	G	F	G	G	Teacher	Nobody	University of Chicago	Sports	Salesman (Notions)
30	15–8	113	E	E	E	G	E	Mechanical Engineer	Mother	University of Illinois	Hunting	Insurance Adjuster
31	15–6	84	F	F	G	G	F	Musician (Accordionist)	Nobody	No	Practice Accordion	Janitor
32	14	126	F	D	F	F	F	Mechanical Engineer	Nobody	University of Illinois	Football	Elevated Conductor
33	15	93	F	D	G	F	F	Forest Ranger	Nobody	University of Notre Dame	Swim	Salesman
34	15–3	98	S	G	F	G	F	Aeronautical Engineer	Nobody	University of Illinois	Home Workshop	Machinist (Tool & Die)
35	15–3	95	F	F	G	G	F	Aeroplane Designer	Nobody	Aero Training School	Aero Models	Cabinet Maker
36	14–6	105	S	G	E	E	E	Forest Ranger	Nobody	University of Illinois	Hunting	Barber
37	14–3	92	G	G	F	G	F	Aeronautical Engineer	Nobody	Lewis Institute	Aero Models	Barber
38	13	116	F	F	F	G	F	Dentist	Nobody	Wright Junior College	Baseball	Tailor
39	14	105	S	E	G	G	F	Electrical Engineer	Parents	University of Illinois	Stamps and Coins	Bricklayer
40	15–6	96	G	G	F	G	F	Forest Ranger	Nobody	Aeronautical College	Sports	Mailman
41	14	99	G	F	G	F	F	Farmer	Nobody	University of Illinois	Collect Fish	Lawyer
42	14–1	109	G	G	F	E	F	Accountant	Nobody	No	Sports	Laborer
43	14–6	103	F	F	F	G	F	Electrical Engineer	Nobody	Wright Junior College	Basketball	Engraver
44	15	87	G	F	F	G	F	Machinist	Friend in Field	Armour Tech	Sports	Milkman
45	14	105	S	E	S	E	E	Teacher	Nobody	Chicago Teachers College	Stamps	Printer
46	16	90	E	F	F	G	G	Agricultural Statistician	Friend in Field	University of Notre Dame	Sports	Policeman
47	15	82	E	G	G	E	F	Electrical Engineer	Nobody	University of Illinois	Photography	Office Clerk

44	15	87	G	F	F	G	F	Machinist	Friend in Field	Armour Tech	Sports	Milkman
45	14	105	S	E	S	E	E	Teacher	Nobody	Chicago Teachers College	Stamps	Printer
46	16	90	E	F	F	G	G	Agricultural Statistician	Friend in Field	University of Notre Dame	Sports	Policeman
47	15	82	E	G	G	E	F	Electrical Engineer	Nobody	University of Illinois	Photography	Office Clerk
48	14–6	96	F	E	F	G	E	Aviator	Nobody	Armour Tech	Collect Match Boxes	Stationary Engineer
49	15–6	84	F	F	D	F	F	Aviator	Father	No	Stamps and Coins	Laborer
50	14	116	E	G	G	G	S	Time Keeper	Father	No	Stamps	Auto Mechanic
51	14–6	95	S	G	G	E	G	Aeroplane Designer	Nobody	Armour Tech	Aero Models	Salesman (Insurance)
52	14	108	E	E	E	E	S	Printer	Uncle in Field	No	Stamps	Bookkeeper
53	14–2	116	E	E	G	E	E	Civil Engineer	Father	Armour Tech	Aero Models	Auto Mechanic
54	14–6	97	G	G	G	G	G	Machinist	Father	Armour Tech	Model Building	Machinist (Tool & Die)
55	15	108	F	F	G	F	F	Aviator	Nobody	No	Models	Lineman (Telephone)
56	14	112	G	G	F	F	G	Pharmacist	Nobody	University of Illinois	Photography	Salesman
57	15	109	S	G	G	G	F	Auto Mechanic	Nobody	No	Models	Carpenter
58	15	91	E	G	G	E	E	Electrician	Brother	No	Coins	Office Clerk
59	13–6	121	G	F	G	E	G	Singer	Brother is Singer	No	Aero Models	Plumber
60	16	85	G	G	G	G	G	Mechanical Engineer	Brother	University of Illinois	Stamps	Postal Clerk
61	14–6	82	G	G	G	F	G	Printer	Uncle in Field	North Park College	Stamps	Watchman
62	14	99	S	E	F	E	E	Mechanical Engineer	Father	Armour Tech	Tropical Fish Breeding	Mechanical Engineer
63	14–6	107	G	G	G	E	G	Electrical Engineer	Father	Purdue University	Models	Lineman (Telephone)
64	14	87	F	F	F	F	G	Auto Mechanic	Uncle	No	Coins	Cobbler
65	15	99	F	F	F	E	G	Draftsman	Father	No	Aero Models	Musician
66	15–6	89	F	D	F	D	G	Electrical Engineer	Father	Coyne Electrical School	Amateur Radio	Businessman (Radio Store)
67	14–6	106	G	G	F	G	G	Pharmacist	Works in Pharmacy	Northwestern University	Stamps	Plumber
68	14	91	E	G	G	G	G	Cartoonist	Nobody	No	Collector of Pictures	Baker
69	16	110	E	E	E	S	E	Chemical Engineer	Friend in Field	Northwestern University	Chemistry	Wool Broker
70	16–5	105	E	E	G	S	E	Chemist	Nobody	Wright Junior College	Chemistry	Cabinet Maker
71	15	89	G	G	G	E	F	Architect	Uncle in Field	University of Michigan	Coins	Tailor
72	16	99	G	F	G	F	G	Dentist	Father	Loyola University	Sports	Dentist
73	15	104	E	F	E	G	G	Electrical Engineer	Nobody	Armour Tech	Coins	Real Estate Operator
74	15–2	95	G	F	G	G	G	Glass Cutter	Father	No	Hiking	Glass Cutter
75	14–6	92	G	G	G	G	G	Architectural Engineer	Nobody	Northwestern University	Wood Carving	Tailor
76	14–6	94	E	F	G	G	F	Mechanical Engineer	Cousin in Field	University of Illinois	Stamps	Tailor
77	15–6	89	F	F	F	D	D	Auto Mechanic	Nobody	No	Stamps	Tailor
78	15	95	G	F	G	G	G	Aviator	Nobody	Armour Tech	Coins	Interior Decorator
79	14–6	104	S	G	F	G	G	Architect	Nobody	No	Collect Labels	Auto Mechanic
80	15	90	G	F	F	F	F	Aviator	Brother	No	Sports	Sign Painter
81	15	92	E	F	G	G	G	Teacher	Nobody	University of Michigan	Stamps	Electrician
82	14	102	G	E	G	E	G	Artist	Nobody	No	Drawing	Janitor
83	14	109	G	E	E	E	E	Baseball Player	Father	No	Collect Fountain Pens	Salesman (Insurance)
84	14–2	109	S	S	G	G	G	Civil Engineer	Nobody	University of Illinois	Coins	Shipping Clerk
85	15	97	G	F	G	G	G	Draftsman	Nobody	No	Models	Machinist
86	15	92	S	G	F	G	F	Hockey Player	Cousin is Player	No	Hockey	Salesman (Laundry)
87	16	89	E	G	D	F	F	Auto Mechanic	Father	No	Home Workshop	Auto Mechanic
88	15	99	E	E	E	E	G	Architect	Friend in Field	Armour Tech	Camping	Auto Mechanic
89	14–6	105	F	G	F	F	G	Jockey	Nobody	No	Pictures of Horses	Laborer
90	14	102	E	G	G	E	G	Aviator	Nobody	Armour Tech	Aeroplane Pictures	Salesman
91	14–6	118	G	E	G	G	F	Aviator	Nobody	Armour Tech	Aero Models	Salesman (Cigar)
92	16	82	S	G	G	G	G	Baseball Player	Nobody	No	Read Sport Stories	Salesman
93	14–6	106	F	F	F	G	G	Aviator	Nobody	Aeronautical College	Hunting	Auto Mechanic
94	15	112	G	F	G	G	F	Electrician	Nobody	No	Fishing	Milkman
95	15–6	85	D	F	F	F	D	Auto Mechanic	Father	No	Home Workshop	Laborer
96	13–6	133	E	S	G	G	E	Draftsman	Father	Armour Tech	Stamps	Machinist (Tool & Die)
97	14	105	E	G	E	G	G	Auto Mechanic	Father	No	Home Workshop	Auto Mechanic
98	14–6	90	F	F	G	F	F	Lawyer	Cousin in Field	Northwestern University	Radio Amateur	Businessman (Grocer)
99	15	102	G	G	G	G	F	Pharmacist	Uncle in Field	University of Illinois	Camping	Auto Salesman
100	14–8	94	G	F	G	G	G	Aviator	Nobody	Aeronautical College	Poetry Writing	Electrician

(Article continued on next page)

Careers Chosen by One Hundred First Semester Technical High School Students

Number of Students	*Occupations*
1	Accountant
4	Architect
1	Artist
14	Aviator
1	Cartoonist
1	Chemist (analysist)
1	Chemist (industrial)
2	Dentist
2	Designer (airplane)
3	Draftsman
5	Electrician
1	Engineer (architectural)
3	Engineer (aeronautical)
2	Engineer (chemical)
2	Engineer (civil)
7	Engineer (electrical)
6	Engineer (mechanical)
2	Farmer
3	Forest ranger
1	Furrier
1	Glass cutter
1	Illustrator
1	Jockey
1	Journalist
2	Lawyer
2	Machinist
1	Mailman
1	Mechanic (airplane)
8	Mechanic (auto)
1	Mechanic (radio)
1	Motorman (street-car)
1	Musician
3	Pharmacist
1	Photographer
2	Printer
2	Professional player (baseball)
1	Professional player (hockey)
1	Reporter
1	Salesman (furniture)
1	Singer
1	Statistician (agricultural)
3	Teacher
1	Time keeper

Various Occupations of Fathers of One Hundred First Semester Technical High School Students

Number of Fathers	*Occupations*
1	Adjuster (insurance)
1	Baker
3	Barber
1	Bookkeeper
1	Bricklayer
1	Broker (wool)
1	Businessman (grocer)
1	Businessman (radio)
2	Cabinet maker
2	Carpenter
2	Clerk (Office)
1	Postal (Clerk)
1	Shipping (Clerk)
1	Cobbler
1	Conductor (elevated)
1	Dentist
1	Egg candler
4	Electrician
1	Engineer (mechanical)
1	Engineer (stationary)
1	Engraver
1	Furrier
1	Glass cutter
1	Interior decorator
2	Janitor
4	Laborer
1	Lawyer
2	Lineman (telephone)
4	Machinist (tool and die)
2	Mailman
10	Mechanic (auto)
2	Milkman
1	Musician
1	Pharmacist
1	Photographer
1	Physician
2	Plumber
1	Policeman
3	Printer
1	Real estate operator
18	Salesman
1	Sign painter
9	Tailor
1	Upholsterer
1	Watchman

Various Hobbies Listed

Airplane models	Drawing
Amateur radio	Camping
Baseball	Fishing
Collecting:	Chemistry
Coins	Home workshop
Fish	Hiking
Comic strips	Hockey
Knives	Hunting
Fountain pens	Ice skating
Railroad stickers	Photography
Match boxes	Sports
Pictures of aeroplanes	Swimming
Pictures of horses	Tropical fish breeding
Stamps	Sport stories
Musical instruments	Poetry writing
Football	Woodcarving

Industrial Arts—A Professional Accounting

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It is always interesting to review progress made in education — to recount the phenomenal growth in size of public education in America, to cite improved teaching methods, and to extol the great teachers. But reminiscing is, at the best, an indoor sport for leisure hours. Educational matters of the present are much too urgent to permit leisure. We need to look ahead and to plan for the present and the immediate future.

This article directs attention to three issues which merit the immediate consideration of industrial-arts teachers and perhaps the attention of other teachers as well. They are:

1. The industrial-arts teacher needs a basic social and educational philosophy.
2. The industrial-arts teacher needs to give more heed to educational research.
3. The industrial-arts teacher needs to exercise greater professional initiative.

Basic Social and Educational Philosophy

One of the outstanding characteristics of the professional person is his broad perspective, his consistency of purpose, and his integrated approach to his work. The teacher in the public schools of America can exhibit this characteristic only if he has a defensible social and educational philosophy. The industrial-arts teacher who lacks a social and educational philosophy may lay claim to being a teacher on the day-laborer basis, but he cannot lay claim to being a professional educator.

A philosophy of life leads to a way of life, but a way of living does not *per se* assure a philosophy of living. Similarly, a philosophy of education leads to a way of educating, but a way of educating does not necessarily imply a philosophy of education. A teacher may teach with no more philosophy of education than a horse which draws a huckster's wagon has a philosophy of business.

Every great educator has been outstanding for his philosophy. Plato, Aristotle, and Christ are examples. Christ, at 30, had formulated his philosophy and in three years presented it in such a manner that it serves as an ideal 1900 years later. While we hold in high regard Christ's teaching methods, the methods in no way compare with the profoundness of His philosophy.

There was a time in the recent past when there were few momentous decisions for the teacher to make. His responsibilities were few in number and clearly defined. The little red school house symbolized the stature of education and the 3 R's represented the program of that era. Society, especially the small communities and rural districts, was likewise lacking in complexity and basic conflict. Society was fortified with stable institutions of home and church. There was a consistency in their expectations of youth and their contributions toward the rearing of youth were mutally complementary.

By way of contrast today the functions of the public schools are not precise, the role of the teacher is not clearly defined; social institutions are subject to continual change; delinquency and crime are on the increase; community controls do not function with their former effectiveness. Aside from these broad social problems there are professional problems such as: What shall constitute a general education? Along what lines shall the curriculum be organized? How shall slow learners be accommodated? How shall rapid learners be challenged to work to capacity?

None of these problems can be solved by a strictly scientific approach even though the scientific method is the reliable means for gathering the data upon which a decision is made. In the last analysis, a choice must be made and the choice rests upon preferred values, i.e., upon a philosophy.

The industrial-arts teacher of 1946 who desires to qualify as a professional person is obliged to have thought through answers to the following and comparable questions: What are the basic precepts of American democracy? What are the functions of the public schools in American society? What concept of a cultured person seems most compatible with a democratic philosophy? What are the implications for industrial arts?

When the industrial-arts teacher has made a study of these questions, when he has gathered the pertinent facts, when he has seen the alternatives, when he has arrived at his conclusions, and when he acts upon these conclusions, he can lay claim to a philosophy of education and he can at the same time regard himself as well on his way toward being a professional educator.

A Regard for Educational Research

A significant part of our public funds is used for research in agriculture, for research in the health sciences, and for research in weapons of war. These public expenditures are supplemented by private funds. Private funds are also used for extensive industrial research. Such research is highly organized and attracts the full-time efforts of some of the nation's best minds. The results of research in these fields startle the imagination as the atomic bomb and penicillin testify. There seems to be little beyond the realm of possibility for the research scientist to produce or refine.

How does research in education compare? Even the question seems ridiculous for it is so out of place.

Practically all of the formal research in education is conducted by graduate students in our universities, financed by the student's own limited funds and performed in isolation from other research. The sponsoring adviser is normally the only co-operating person. The isolated piece of research conducted by the graduate student and offered in partial fulfillment for his degree is likely to be his last major research undertaking unless he becomes a college professor and in turn directs the research work of future graduate students. A few large cities do set aside limited funds for curriculum research — usually funds to cover printing costs, and most large cities do spend money for surveys and "nose-counting" studies. Very little of this can rightfully qualify as research and most of it can be done by trained clerks.

It is encouraging to point out that where educators have had the money, time, personnel, and facilities to carry on research, they have shown themselves capable and they have proved that education does lend itself to research techniques. The fields of reading, arithmetic, handwriting, and speech are cases in point.

The *Review of Educational Research* reports systematically on research in the various fields of education. According to the October 1944 issue,[1] there were 65 research studies conducted in the combined fields of industrial arts and vocational-industrial education for the *three year* period 1941 to 1944. Of the 65, 44 were masters' theses and doctoral dissertations. It takes a generous stretch of the imagination to consider some of the research titles, such as: "Graphic Arts Enrollment," "Training War Workers for Aircraft Industry," and "Teacher Personnel Shortages in Industrial Arts."

Assuming the 1941–1944 period to be abnormal because of the war, I turned to the February, 1938[2] issue which reports on the period January, 1934 to July, 1937. There I found 62 industrial-arts studies reported, 51 of which were masters' theses and doctoral dissertations. I should add that subject fields other than industrial arts followed the same pattern.

The surest way to remove the mysticism from teaching and learning and to make it impractical for the high school graduating bobby soxer to do as good a job of teaching as the professionally prepared teacher is by means of research. Through research, we can document our points of view, we can increase and systematize the subject matter of our profession, we can refine our instructional procedures for all types of pupils, and we can appraise our

[1]John A. Whitesel, "Industrial Education," *Review of Educational Research*, 14: 311–320, October, 1944.
[2]Elmer W. Christy, "Industrial Arts," *Review of Educational Research*, 8: 47–51, February, 1938.

Industrial-arts laboratory, Chicago Public Schools. Dr. Louis V. Newkirk, Director, Bureau of Industrial Arts

outcomes. Research is a hard taskmaster, but we have avoided the hard way about as long as we dare.

Industrial and Agricultural Research

A society which spends billions for research to refine its technology and agriculture and ignores its educational research is creating for itself a sociological "Frankenstein." Technical developments create social problems which are more perplexing than were the problems that beset the technicians.

The educator, however, is not blameless in the matter. The typical educator is inclined to avoid the findings of educational research. We have much reliable information on the teaching of reading, but many teachers of reading have not availed themselves of this information. We know the optimum size of class at the lower maturity levels but we have persistent administrative policies which assign forty or more pupils to beginning classes. We have reliable data on children's capacities to do conventional school work but these data are disregarded in a wholesale manner. In the field of industrial-arts education we can arrive at sound conclusions regarding the size of shop required to do an effective job of instruction; the quantity and quality of light needed in the shop is well established; the proportion of work stations to the size and type of class is known. Yet shops are being planned currently which give little heed to these data. If the obvious and tangible aspects of good industrial-arts programs are disregarded it is of little wonder that the more subjective phases are completely ignored.

How long would we continue with the services of a physician who insisted upon treating an ailment not only in an outmoded manner but in a harmful manner? In education, we seem unmindful that an analogous issue exists.

Industrial-arts teachers and educators in general need not only organized research but we need also a research attitude on the part of teachers and administrators and a willingness to accept reliable research findings.

The Need for Professional Initiative

There is much complaining to be heard among industrial-arts teachers who have remained in the profession. Low salaries, inadequate instructional facilities, too large classes, too heavy teaching load, and unfair competition from persons lacking professional preparation appear to be the main issues. It all adds up to a lack of job satisfaction.

What is the root of the difficulty?

It seems to the writer that the present dilemma of teachers is caused by: (1) Lack of initiative to control their own well being; and (2) Lack of opportunity to do effective teaching.

For example, other professions and the trades as well are directly concerned with the selection, preparation, and certification of their new members. The medical profession exercises very strict control as does the legal profession. The same may be said of professional engineers. Bricklayers, plumbers, carpenters, and electricians maintain regulations which govern the number of apprentices, the duration and content of their apprenticeship and, in their better moments, these groups do something to maintain a standard of craftsmanship.

With teaching, the story is different. The selection, preparation, and certification of new members to the teaching profession is handled by persons who are not answerable to the members of the profession. During the past five years, an estimated 350,000 teachers have left the profession. To compensate for the lack of qualified teachers, there has been a general watering down of teaching requirements to a point where the broth is tasteless. Teachers have stood idly by while it has been proved to them that any available person of good character is acceptable as a full professional colleague. Those who sit in the saddle have been more concerned with keeping the jobs filled with living, breathing organisms than with correcting the cause for the "decimation" of the teaching ranks.

The industrial-arts teacher feels this even more keenly, since his position is subject to the competition of the local carpenter who has developed a heart condition or the town handy man who seeks to supplement his seasonal work.

Meanwhile, we have had a shortage of physicians, a shortage of carpenters, a shortage of plumbers, and the like. But have medical schools reduced the time of preparation? Have plumbers reduced the apprenticeship period? Have carpenter apprentices been taken on in droves? The upshot of the matter is that we have more rigid standards for our plumbing, wiring, and bricklaying trades personnel than we have for educational personnel.

The Teacher in an Economy of Supply and Demand

Teachers colleges and colleges of education are outdoing one another to excel in enrollment. Teacher organizations are exerting themselves in recruitment campaigns. If there was to be a general reduction in public school class size, necessitating a great increase in size of staff, then this effort to gain numbers would seem justifiable. The same would be true if school functions were to increase noticeably. But the only general expansion of staff contemplated is the expansion which will be made necessary by the recently increased birth rate.

We are operating in an economy of "supply and demand" as the recent passing of price controls testifies. The medical profession has followed this same policy for quite some time insisting that it can provide a high caliber of physician through careful selection and preparation followed by satisfying employment. The public school teachers constitute a large economic group which acts as if it were outside the jurisdiction of the law of supply and demand.

Where shall teachers look for help?

They can search for help in many quarters but if they want to make progress they will have to look within their own ranks to find leadership. Teachers need to act professionally in gaining greater control of their profession. They should set the standards for the profession uniformly high. They should develop a plan whereby the teachers, through delegated representatives, would pass upon the qualifications of those who seek to teach. They need to adhere to a professional code of ethics. They should work for the elimination of lifetime certification.

Teachers should put themselves in a position to assist in determining school policy and program. This type of participation would carry with it corresponding responsibilities. A first responsibility would be for the individual teacher to maintain a high degree of teaching competence. A second and associated responsibility would be the joint disapproval and rejection of those teachers who neglect to maintain competence.

The goal of the teaching profession should be to make teaching satisfying and worthwhile to the point where capable young people would be attracted to it. Then the problem would be not one of recruitment but one of selection and acceptance. *The goal is not a selfish one. Instead it is the only means whereby we can give to the boys and girls of America the kind of education they deserve.* The first essential for a good school is good teachers.

What are the odds? It is easy to say that education changes slowly; that its ineritia precludes any significant improvement in a short period of time. Such a statement is as debilitating as it is impertinent. It is a philosophy of defeat.

The teachers in our classrooms have taught the lessons of the greatness of our country. The early settlers fought starvation, cold weather, and the Indians. The Thirteen Colonies resisted a mighty empire — passed through Valley Forge and countless other hardships and came out victorious. The pioneers marched westward against the odds of wilderness, the elements, hostile natives and secured the nation from coast to coast. The America of 1941–1945 was the arsenal of democracy and since then the breadbasket of the world. Is it possible that the teachers of our boys and girls who are responsible for passing on these traditions, emblazoned in their true glory, are not zealous to meet difficulties which stand between them and a better educational program for the youth of America?

The answer must come from the teachers themselves.

Nature study alphabet submitted by F. N. Newton, Jr., Supervisor, Industrial Education Department, High School, Sharon, Pa.

MACHINE-DRAFTING DATA 1

LETTERS AND NUMERALS A

ABCDEFGHIJKLMNOPQRSTUVWX

YZ & 1234567890 $\frac{1}{8}$ $\frac{9}{32}$ $\frac{57}{64}$

TITLES WILL BE $\frac{3}{16}$, SUB-TITLES $\frac{1}{8}$ & NOTES $\frac{3}{32}$ HIGH.

SPACE "TRIANGULAR" & "PARALLEL" LETTERS AS: BOLT not BOL T, MINIMUM not MINIMUM. KEEP LETTERS UNIFORM IN WEIGHT & SLANT.

FINISH MARKS B

SYMBOL	ROUGHNESS IN MICRO-INCHES	FINISH
$\sqrt{}$	63M, 16M, 4M	ROUGH
$\sqrt{}$	1M, 250, 63	SMOOTH
$\sqrt{}$	32, 16, 8	GRIND
$\sqrt{}$	4, 2, 1	LAP

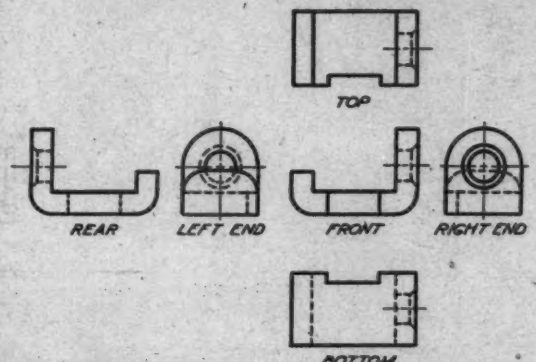
FINISH MARK MACHINED SURFACES OF CASTINGS & FORGINGS-ALSO GROUND SURFACES. DO NOT FINISH MARK DRILLED, BORED, REAMED, C'BORED, C'SUNK OR SPOT FACED HOLES.

FOR FURTHER INFORMATION SEE A.S.A.-114.1- & A.S.A.-B46-

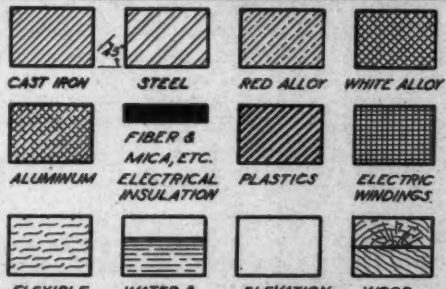
LINES C

TYPE	FOR PENCIL TRACINGS	FOR INK TRACINGS
VISIBLE OUTLINE	MEDIUM	HEAVY
INVISIBLE OUTLINE	MEDIUM	MEDIUM
CENTER LINE	LIGHT	LIGHT
DIMENSION AND EXTENSION LINES	LIGHT 3/4	LIGHT 3/4
SECTION LINE	LIGHT	LIGHT
CUTTING PLANE	MEDIUM	HEAVY
BREAK LINES	MEDIUM / LIGHT	HEAVY / LIGHT
ADJACENT PART AND ALTERNATE POSITION	MEDIUM	MEDIUM

LOCATION OF ALL VIEWS D



SECTIONS E

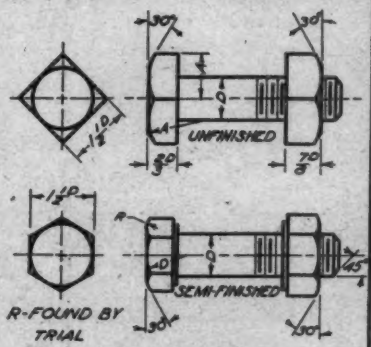


SECTION ALL DETAILS AS FOR CAST IRON.

USE OTHER CROSS SECTIONS IN ASSEMBLIES ONLY.

A.S.A.-314.1-

BOLT AND NUT CONSTRUCTION F



ENGINEERING DRAWING, FRENCH

ORDER OF PENCILING G

1. BLOCK IN VIEWS TO BALANCE SHEET.
2. DRAW CENTER LINES.
3. WORK OUT VIEWS TOGETHER USING LIGHT LINES.
4. CHECK THE PROJECTION OF VIEWS.
5. CLEAN DRAWING AND REMOVE SUPERFLUOUS LINES.
6. DARKEN OUTLINES TO FINISHED DRAWING WEIGHT.
7. DIMENSION AND ADD NOTES.
8. SECTION CUT SURFACES.
9. ADD TITLE, NUMBER, ETC.
10. CHECK THE DRAWING.

ORDER OF INKING K

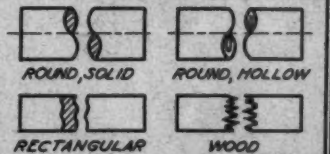
1. TRACE VISIBLE CIRCLES, ARCS & IRREGULAR CURVES.
2. TRACE HORIZONTAL VISIBLE LINES.
3. TRACE VERTICAL VISIBLE LINES.
4. TRACE SLANTING VISIBLE LINES.
5, 6, 7, 8. TRACE INVISIBLE LINES IN THE SAME ORDER (1, 2, 3, 4).
9. TRACE CENTER, EXTENSION, AND DIMENSION LINES.
10. TRACE ARROWHEADS AND DIMENSIONS.
11. SECTION LINE CUT SURFACES.
12. LETTER NOTES, TITLE, & NUMBER.
13. CHECK THE TRACING.

ABBREVIATIONS H

ASSEMBLY	ASSM	LEFT HAND	LH
ALTERNATING CURRENT	AC	MACHINE STEEL	MACH ST
ALUMINUM	AL	MALLEABLE IRON	MAL I
AMERICAN WIRE GAGE	AWG	MATERIAL	MAT
AND	&	MAXIMUM	MAX
APPROXIMATE	APPR	MINIMUM	MIN
BABBITT	BAB	NATIONAL COARSE	N C
BIRMINGHAM WIRE GAGE	BWG	NATIONAL FINE	NF
BRASS	BR	NATIONAL EXTRA FINE	NEF
BRONZE	BZ	NATIONAL (FORM)	N
BRONZE, SPRING	SP BZ	NUMBER	NO or #
CAST IRON	C I	PATTERN	PATT
CENTER LINE	℄	PLATE	PL
COLD ROLLED STEEL	CR ST	PLUS OR MINUS	±
COPPER	COP	POUND	LB or #
COUNTERBORE	C BR	RADIUS	R
COUNTERSINK	C SK	REQUIRED	REQ
DEGREE, MINUTE, SECOND	° ' "	REVOLUTIONS PER MIN	R P M
DIAMETER	D	RIGHT HAND	RH
DIRECT CURRENT	DC	ROUND	RD
DRAWING	DWG	SCREW	SCR
FILLISTER	FIL	SECTION	SECT
FOOT OR FEET	FT or '	SHEET	SH
FORGING	FORG	SOCKET	SOC
GALVANIZED IRON	GALV I	SQUARE	SQ
HARDEN AND GRIND	HDN & GR	STANDARD	STD
HEAD (LESS)	HD (LESS)	THREAD	THD
HEXAGON	HEX	TOOL STEEL	T ST
HORSE POWER	HP	U.S. STANDARD GAGE	USG
INCH OR INCHES	IN or "	WASHBURN & MOEN GAGE	W&M G

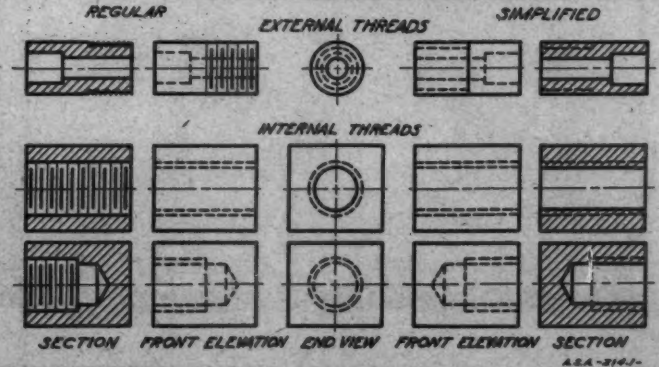
OMIT THE PERIOD AFTER A STANDARD ABBREVIATION. THE ABOVE MAY BE COMBINED AS: FIL HD MACH SCR.

BREAKS J



A.S.A.-314.1-

THREAD REPRESENTATIONS L



A.S.A.-314.1-

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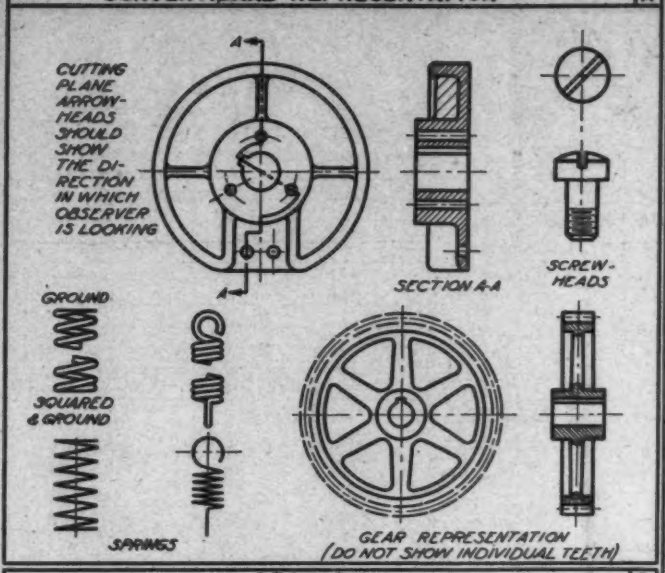
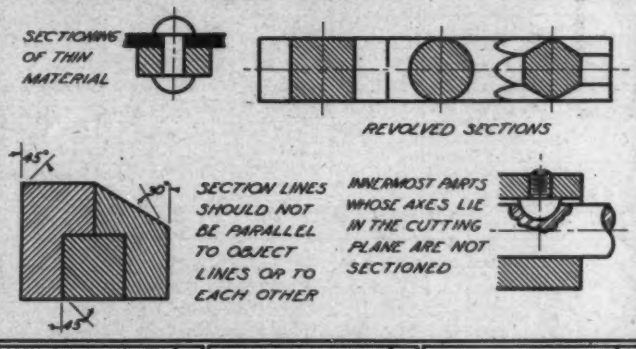
Data table for drafting room by H. D. Campbell, Cicero, Ill.

2 MACHINE-DRAFTING DATA

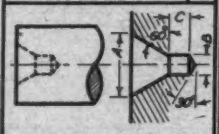
CONVENTIONAL REPRESENTATION A



SECTIONS B


SECTIONING OF THIN MATERIAL
REVOLVED SECTIONS
45°
30°
45°
SECTION LINES SHOULD NOT BE PARALLEL TO OBJECT LINES OR TO EACH OTHER
INNERMOST PARTS WHOSE AXES LIE IN THE CUTTING PLANE ARE NOT SECTIONED

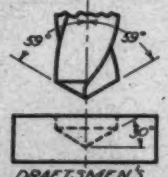
CENTERS C



A = APPROXIMATELY $\frac{1}{4}$ OF SHAFT DIA.
B = $\frac{1}{4}$ OF A C = B

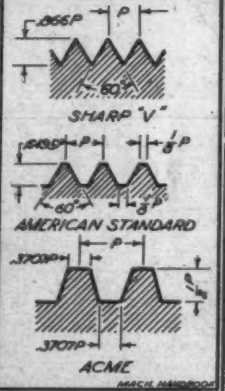
FORD TRADE SCHOOL

DRILLED HOLE D



DRAFTSMEN'S APPROXIMATION

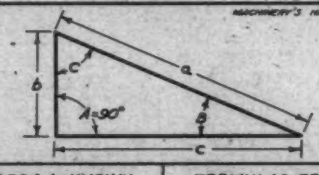
THREAD PROFILES E



MACH. HANDBOOK

RIGHT TRIANGLE SOLUTIONS F

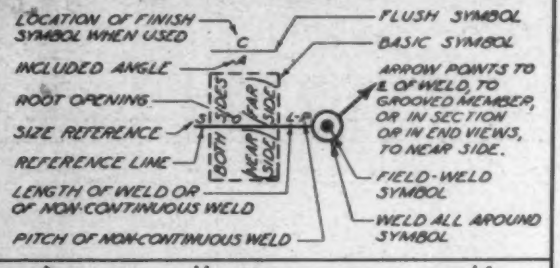
MACHINERY'S HANDBOOK

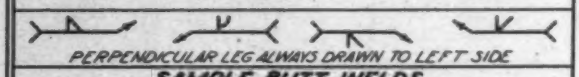


SIDES & ⦟s KNOWN	FORMULAS FOR SIDES & ⦟s TO BE FOUND		
SIDES a AND b	$c = \sqrt{a^2+b^2}$	$\sin B = \frac{b}{a}$	$C = 90° - B$
SIDES a AND c	$b = \sqrt{a^2-c^2}$	$\sin C = \frac{c}{a}$	$B = 90° - C$
SIDES b AND c	$a = \sqrt{b^2+c^2}$	$\tan B = \frac{b}{c}$	$C = 90° - B$
SIDE a; ANGLE B	$b = a \times \sin B$	$c = a \times \cos B$	$C = 90° - B$
SIDE a; ANGLE C	$b = a \times \cos C$	$c = a \times \sin C$	$B = 90° - C$
SIDE b; ANGLE B	$a = \frac{b}{\sin B}$	$c = b \times \cot B$	$C = 90° - B$
SIDE b; ANGLE C	$a = \frac{b}{\cos C}$	$c = b \times \tan C$	$B = 90° - C$
SIDE c; ANGLE B	$a = \frac{c}{\cos B}$	$b = c \times \tan B$	$C = 90° - B$
SIDE c; ANGLE C	$a = \frac{c}{\sin C}$	$b = c \times \cot C$	$B = 90° - C$

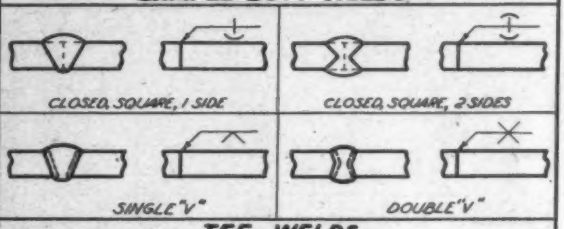
FUSION WELDING SYMBOLS G

TYPE OF WELD										
BEAD	FILLET	GROOVE: SQ	GROOVE: "V"	GROOVE: BEVEL	GROOVE: "U"	GROOVE: "J"	PLUG & SLOT	FIELD WELD	WELD ALL AROUND	FLUSH

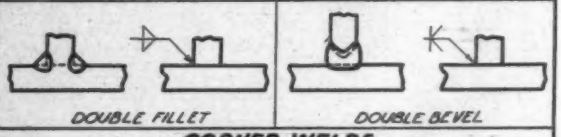




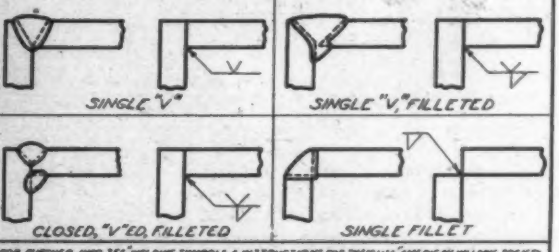
SAMPLE BUTT WELDS



TEE WELDS



CORNER WELDS



FOR FURTHER INFO SEE "WELDING SYMBOLS & INSTRUCTIONS FOR THEIR USE" AMERICAN WELDING SOCIETY

S.A.E. STEEL SPECIFICATIONS H

NO.	USES (MACH HANDBOOK)
1008 1010 1015	NEARLY PURE IRON IN SHEET, STRIP, & ROD. BEST FOR DRAWING AND HOT AND COLD FORMING. CAN NOT BE HARDENED.
1020 1022 1024	A STANDARD CARBURIZING GRADE OF CARBON STEEL FOR MACHINED PARTS WHERE HIGH STRENGTH IS NOT NEEDED.
1035 1040 1045	MEDIUM CARBON STEEL CAPABLE OF DEEP HARDENING. USED FOR FORGINGS, TUBING, KEY STOCK, ETC.
1055 1060 1066	CARBON STEEL USED FOR COIL SPRINGS, LOCK WASHERS, ETC.
1080 1085 1095	HIGH CARBON STEEL USED FOR CUTTING TOOLS, DRILL ROD, PINS, LEAF SPRINGS, ETC
2317 2330 2345	NICKEL STEEL USED PRIMARILY FOR CARBURIZING WHERE STRENGTH & TOUGHNESS ARE DESIRED AS IN GEARS, ETC.
3115 3130 3140	NICKEL-CHROMIUM STEEL USED WHERE GREATER STRENGTH & TOUGHNESS IS DESIRED THAN IS POSSIBLE WITH PLAIN CARBON STEELS
4615	NICKEL MOLYBDENUM STEEL USED WHERE HIGH FATIGUE RESISTANCE & TENSILE PROPERTIES ARE DESIRED.
6150	CHROMIUM-VANADIUM STEEL USED FOR HIGH STRENGTH & ANTI-FATIGUE QUALITIES: LEAF & COIL SPRINGS, GEARS, SHAFTS, & HEAVY FORGINGS.

Data table for drafting room by H. D. Campbell, Cicero, Ill.

MACHINE-DRAFTING DATA 3

CAP-SCREW HEADS A

A = DISTANCE ACROSS FLATS OF HEX.

ASA B18C-1930

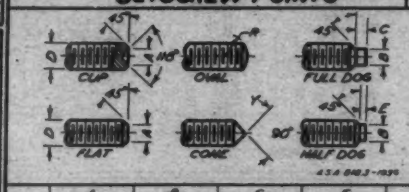
D	A (1)	B (2)	C (3)	E (1)	F (1)	G (1)	H (1)	J (1)	K (1)	L	M (1)	N (2)	P (1)
1/4	7/16	.488	3/16	7/16	.191	3/8	11/64	.044	1/2	.146	3/8	3/16	1/4
5/16	1/2	.557	15/64	9/16	.246	7/16	13/64	.050	5/8	.183	7/16	7/32	5/16
3/8	9/16	.628	9/32	5/8	.273	9/16	1/4	.064	3/4	.220	9/16	5/16	3/8
7/16	5/8	.698	21/64	3/4	.328	5/8	19/64	.071	13/16	.220	5/8	5/16	7/16
1/2	3/4	.840	3/8	13/16	.355	3/4	21/64	.084	7/8	.220	3/4	3/8	1/2
9/16	13/16	.910	27/64	15/16	.410	13/16	3/8	.091	1	.256	13/16	3/8	9/16
5/8	7/8	.980	15/32	1	.438	7/8	27/64	.099	1-1/8	.293	7/8	1/2	5/8
3/4	1	1.121	9/16	1-1/4	.547	1	1/2	.112	1-3/8	.366	1	9/16	3/4

SETSCREW HEADS B

MACH. HANDBOOK ASA B18.2-1935

SIZE	D		A	R	F	G
5	.125	1/8			1/16	1/16
6	.138	9/64			1/16	5/64
8	.164	5/32			5/64	3/32
10	.190	3/16			3/32	7/64
12	.216	7/32			3/32	7/64
1/4			3/16	5/8	1/8	9/64
5/16			15/64	25/32	5/32	3/16
3/8			9/32	15/16	3/16	7/32

SETSCREW POINTS D



ASA B18.2-1935

D	A (1)	A (3)	B (1)	B (3)	C (1)	C (3)	E (1)	E (3)	R
5	.067	1/16	.083	3/32	.06	1/16	.03	1/32	3/32
6	.074	5/64	.092	3/32	.07	5/64	.03	1/32	7/64
8	.087	3/32	.109	7/64	.08	5/64	.04	3/64	1/8
10	.102	3/32	.127	1/8	.09	3/32	.04	3/64	9/64
12	.115	1/8	.144	9/64	.11	7/64	.05	1/16	5/32
1/4	.132	1/8	5/32		1/8		1/16		3/16
5/16	.172	11/64	13/64		5/32		5/64		15/64
3/8	.242	7/32	1/4		3/16		3/32		9/32

IF LENGTH IS LESS THAN D, THEN (Y = 118°)

MACHINE-SCREW HEADS C

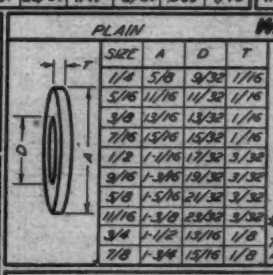
ASA B18C-1930

NO.	D (1)	D (3)	A (1)	A (3)	B (1)	B (3)	C (1)	C (3)	E (1)	E (3)	F (1)	F (3)	G (1)	G (3)	H (1)	H (3)
2	.086	3/32	.172	11/64	.051	1/16	.162	5/32	.070	5/64	.140	9/64	.055	1/16	.029	1/32
4	.112	7/64	.225	7/32	.067	1/16	.211	7/32	.086	3/32	.183	3/16	.072	5/64	.037	1/32
5	.125	1/8	.252	1/4	.075	5/64	.236	15/64	.095	3/32	.205	13/64	.081	5/64	.041	3/64
6	.138	9/64	.279	9/32	.083	5/64	.260	17/64	.103	7/64	.226	7/32	.089	3/32	.045	3/64
8	.164	5/32	.332	21/64	.100	3/32	.309	5/16	.119	1/8	.270	17/64	.106	7/64	.053	3/64
10	.190	3/16	.385	3/8	.116	7/64	.359	23/64	.136	9/64	.313	5/16	.123	1/8	.061	1/16
12	.216	7/32	.438	7/16	.132	1/8	.408	13/32	.152	5/32	.357	23/64	.141	9/64	.069	1/16

SHAKEPROOF WASHERS E

SIZE	2	3	4	6	8	10	1/4	5/16	3/8
A			9/32	5/16	3/8	13/32	1/2	19/32	11/16
B	3/16	7/32	17/64	9/32	21/64	3/8	15/32	19/32	11/16
C	.010	.012	.015	.018	.019	.021	.025	.030	.035

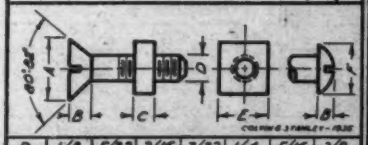
WASHERS F



SIZE	A	D	T
1/4	5/8	9/32	1/16
5/16	11/16	11/32	1/16
3/8	13/16	13/32	1/16
7/16	15/16	15/32	1/16
1/2	1-1/16	17/32	3/32
9/16	1-3/16	19/32	3/32
5/8	1-5/16	21/32	3/32
11/16	1-3/8	23/32	3/32
3/4	1-1/2	13/16	1/8
7/8	1-3/4	15/16	1/8

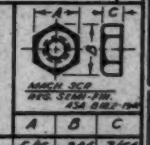
SIZE	D (1)	D (2)	A (1)	A (2)	W	T *
1/4	.265	17/64	.453	29/64	3/32	1/16
5/16	.328	21/64	.578	37/64	1/8	1/16
3/8	.390	25/64	.640	41/64	1/8	3/32
7/16	.453	29/64	.767	49/64	5/32	1/8
1/2	.515	33/64	.859	55/64	11/64	1/8
9/16	.593	19/32	.968	31/32	3/16	1/8
5/8	.655	21/32	1.062	1-1/16	13/64	5/32
11/16	.718	23/32	1.155	1-5/32	7/32	3/16
3/4	.780	25/32	1.299	1-9/32	1/4	3/16

STOVE BOLTS G



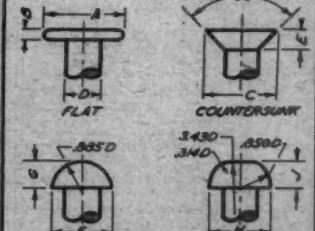
D	1/8	5/32	3/16	7/32	1/4	5/16	3/8
THDS	40	32	24	24	20	18	16
A	1/4	11/32	3/8	7/16	1/2	5/8	3/4
B	3/64	3/32	1/8	1/8	5/32	3/16	7/32
C	7/64	1/8	1/8	5/32	3/16	7/32	1/4
E	5/16	11/32	3/8	7/16	7/16	9/16	5/8
F	1/4	5/16	11/32	13/32	15/32	9/16	11/16

HEX NUTS H



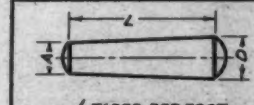
SIZE OF SCREW	A	B	C
6	5/16	.344	7/64
8	11/32	.378	1/8
10	3/8	.413	1/8
12	7/16	.482	5/32
1/4	7/16	.485	13/64
5/16	9/16	.624	1/4
3/8	5/8	.691	5/16

SMALL RIVETS J



D	A	B	C	E	F	G	H	J
3/32	.100	.032	.176	.040	.166	.071	.163	.054
1/8	.250	.042	.234	.053	.219	.094	.215	.082
5/32	.312	.052	.289	.066	.273	.117	.268	.089
3/16	.374	.062	.346	.079	.327	.140	.321	.107
7/32	.440	.073	.407	.094	.385	.165	.378	.126
1/4	.500	.083	.463	.106	.438	.188	.429	.143
9/32	.562	.094	.520	.119	.492	.211	.482	.161
5/16	.624	.104	.577	.133	.546	.234	.535	.178
11/32	.686	.114	.635	.146	.600	.257	.589	.196
3/8	.750	.125	.694	.159	.656	.281	.644	.215
7/16	.874	.146	.808	.186	.765	.328	.750	.250

TAPER PINS K



FORMULA FOR "A"

L = LENGTH

$A = D - \frac{L \times .25}{12}$

¼ TAPER PER FOOT

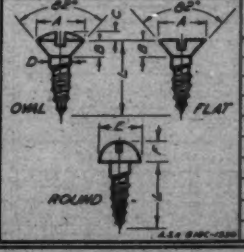
MACH. HANDBOOK

SIZE		6-0	5-0	4-0	3-0	2-0	0	1	2
D	DEC.	.078	.094	.109	.125	.141	.156	.172	.193
	FRAC.	5/64	3/32	7/64	1/8	9/64	5/32	11/64	3/16

SIZE		3	4	5	6	7	8	9	10
D	DEC.	.219	.250	.289	.341	.409	.492	.591	.706
	FRAC.	7/32	1/4	19/64	11/32	13/32	1/2	19/32	45/64

TO FIND "A" USE FORMULA OR HANDBOOK
STANDARD RANGE OF LENGTHS OF TAPERS MAY ALSO BE FOUND IN HANDBOOK

WOOD SCREWS L



NO.	D (1)	D (3)	A (1)	B (1)	C (1)	E (1)	F (1)	LENGTH RANGE
0	.060	1/16	7/64	1/32	1/64	7/64	3/64	1/4 - 3/8
1	.073	5/64	9/64	3/64	1/64	9/64	1/16	1/4 - 1/2
2	.086	3/32	11/64	3/64	1/32	5/32	1/16	1/4 - 3/4
3	.099	3/32	3/16	1/16	1/32	3/16	5/64	1/4 - 1
4	.112	7/64	7/32	1/16	1/32	13/64	5/64	1/4 - 1-1/2
5	.138	9/64	9/32	5/64	3/64	1/4	3/32	3/8 - 2-1/2
6	.164	5/32	21/64	3/32	3/64	19/64	7/64	3/8 - 3
8	.190	3/16	3/8	7/64	1/16	23/64	1/8	1/2 - 3-1/2
10	.216	7/32	7/16	1/8	1/16	25/64	5/32	5/8 - 4
12	.242	1/4	31/64	9/64	5/64	29/64	11/64	3/4 - 5

NOTE:- IN ABOVE TABLES (1)=MAXIMUM DIMENSION; (2)=MINIMUM DIMENSION; (3)=APPROXIMATE FRACTIONAL EQUIVALENT.

Data table for drafting room by H. D. Campbell, Cicero, Ill.

4 MACHINE-DRAFTING DATA

DECIMAL EQUIVALENTS A

1/64	.015625
1/32	.03125
3/64	.046875
1/16	.0625
5/64	.078125
3/32	.09375
7/64	.109375
1/8	.1250
9/64	.140625
5/32	.15625
11/64	.171875
3/16	.1875
13/64	.203125
7/32	.21875
15/64	.234375
1/4	.2500
17/64	.265625
9/32	.28125
19/64	.296875
5/16	.3125
21/64	.328125
11/32	.34375
23/64	.359375
3/8	.3750
25/64	.390625
13/32	.40625
27/64	.421875
7/16	.4375
29/64	.453125
15/32	.46875
31/64	.484375
1/2	.5000
33/64	.515625
17/32	.53125
35/64	.546875
9/16	.5625
37/64	.578125
19/32	.59375
39/64	.609375
5/8	.6250
41/64	.640625
21/32	.65625
43/64	.671875
11/16	.6875
45/64	.703125
23/32	.71875
47/64	.734375
3/4	.7500
49/64	.765625
25/32	.78125
51/64	.796875
13/16	.8125
53/64	.828125
27/32	.84375
55/64	.859375
7/8	.8750
57/64	.890625
29/32	.90625
59/64	.921875
15/16	.9375
61/64	.953125
31/32	.96875
63/64	.984375
1	1.0000

DRILLS TO 1/2" D B

SIZE	DEC.	SIZE	DEC.
80	.0135	21	.159
79	.0145	20	.161
1/64	.0156	19	.166
78	.016	18	.1695
77	.018	11/64	.1718
76	.020	17	.173
75	.021	16	.177
74	.0225	15	.180
73	.024	14	.182
72	.025	13	.185
71	.026	3/16	.1875
70	.028	12	.189
69	.0292	11	.191
68	.031	10	.1935
1/32	.0312	9	.196
67	.032	8	.199
66	.033	7	.201
65	.035	13/64	.2031
64	.036	6	.204
63	.037	5	.2055
62	.038	4	.209
61	.039	3	.213
60	.040	7/32	.2187
59	.041	2	.221
58	.042	1	.228
57	.043	A	.234
56	.0465	15/64	.2343
3/64	.0468	B	.238
55	.052	C	.242
54	.055	D	.246
53	.0595	1/4	.250
1/16	.0625	E	.250
52	.0635	F	.257
51	.067	G	.261
50	.070	17/64	.2656
49	.073	H	.266
48	.076	I	.272
5/64	.0781	J	.277
47	.0785	K	.281
46	.081	9/32	.2812
45	.082	L	.290
44	.086	M	.295
43	.089	19/64	.2968
42	.0935	N	.302
3/32	.0937	5/16	.3125
41	.096	O	.316
40	.098	P	.323
39	.0995	21/64	.3281
38	.1015	Q	.332
37	.104	R	.339
36	.1065	11/32	.3437
7/64	.1093	S	.348
35	.110	T	.358
34	.111	23/64	.3593
33	.113	U	.368
32	.116	3/8	.375
31	.120	V	.377
1/8	.125	W	.386
30	.1285	25/64	.3906
29	.136	X	.397
28	.1405	Y	.404
9/64	.1406	13/32	.4062
27	.144	Z	.413
26	.147	27/64	.4218
25	.1495	7/16	.4375
24	.152	29/64	.4531
23	.154	15/32	.4687
5/32	.1562	31/64	.4843
22	.157	1/2	.500

WEIGHTS OF METALS C

POUNDS PER CUBIC INCH	
ALUMINUM, CAST	.0924
ALUM., WROUGHT	.0975
BRASS, 70C-30Z	.3032
CAST IRON	.2600
COPPER	.3184
STEEL (MACH. HANDBOOK)	.2916

NATIONAL THREAD SERIES D

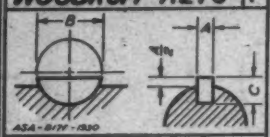
SIZE	TH'DS PER IN	DIAM.	TAP DRILL
COARSE			
1	64	.073	53
2	56	.086	50
3	48	.099	47
4	40	.112	43
5	40	.125	38
6	32	.138	36
8	32	.164	29
10	24	.190	25
12	24	.216	16
1/4	20	.250	7
5/16	18	.3125	F
3/8	16	.375	5/16
7/16	14	.4375	U
1/2	13	.500	27/64
9/16	12	.5625	31/64
5/8	11	.625	17/32
3/4	10	.750	21/32
7/8	9	.875	49/64
1	8	1.000	7/8
1-1/8	7	1.125	63/64
1-1/4	7	1.250	1-7/64
1-1/2	6	1.500	1-11/32
FINE			
0	80	.060	3/64
1	72	.073	53
2	64	.086	50
3	56	.099	45
4	48	.112	42
5	44	.125	37
6	40	.138	33
8	36	.164	29
10	32	.190	21
12	28	.216	M
1/4	28	.250	3
5/16	24	.3125	I
3/8	24	.375	Q
7/16	20	.4375	25/64
1/2	20	.500	29/64
9/16	18	.5625	33/64
5/8	18	.625	37/64
3/4	16	.750	11/16
7/8	14	.875	13/16
1	14	1.000	15/16
1-1/8	12	1.125	1-3/64
1-1/4	12	1.250	1-11/64
1-1/2	12	1.500	1-27/64
EXTRA FINE *			
1/4	36	.250	#2
5/16	32	.3125	9/32
3/8	32	.375	11/32
7/16	28	.4375	Y
1/2	28	.500	15/32
9/16	24	.5625	33/64
5/8	24	.625	37/64
3/4	20	.750	49/64
7/8	20	.875	57/64
1	20	1.000	61/64
1-1/8	18	1.125	1-5/64
1-1/4	18	1.250	1-13/64
1-1/2	18	1.500	1-29/64

* FROM FORMULA IN MACH. HANDBOOK

NATIONAL STD PIPE THREADS E

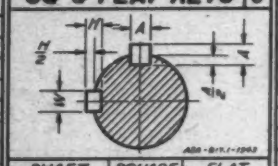
NOMINAL INSIDE DIAM.	TH'DS PER INCH	THICK. IN INCHES	ACTUAL OUTSIDE DIAM.
1/8	27	.068	.405
1/4	18	.088	.540
3/8	18	.091	.675
1/2	14	.109	.840
3/4	14	.113	1.050
1	11-1/2	.133	1.315
1-1/4	11-1/2	.140	1.660
1-1/2	11-1/2	.145	1.900

WOODRUFF KEYS F

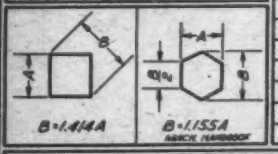


KEY NO.	A BY B	C
204	1/16 X 1/2	13/64
304	3/32 X 1/2	13/64
305	3/32 X 5/8	1/4
404	1/8 X 1/2	13/64
405	1/8 X 5/8	1/4
406	1/8 X 3/4	5/16
505	5/32 X 5/8	1/4
506	5/32 X 3/4	5/16
507	5/32 X 7/8	3/8
606	3/16 X 3/4	5/16
607	3/16 X 7/8	3/8
608	3/16 X 1	7/16
609	3/16 X 1-1/8	31/64
808	1/4 X 1	7/16
810	1/4 X 1-1/4	35/64
812	1/4 X 1-1/2	41/64
1008	5/16 X 1	7/16
1010	5/16 X 1-1/4	35/64
1012	5/16 X 1-1/2	41/64

SQ & FLAT KEYS G



SHAFT DIAMETER	SQUARE A BY A	FLAT W BY M
1/2 AND 9/16	1/8 X 1/8	1/8 X 3/32
5/8 TO 7/8	3/16 X 3/16	3/16 X 1/8
15/16 TO 1-1/4	1/4 X 1/4	1/4 X 3/16
1-5/16 TO 1-3/8	5/16 X 5/16	5/16 X 1/4
1-7/16 TO 1-3/4	3/8 X 3/8	3/8 X 1/4
1-13/16 TO 2-1/4	1/2 X 1/2	1/2 X 3/8
2-5/16 TO 2-3/4	5/8 X 5/8	5/8 X 7/16
2-7/8 TO 3-1/4	3/4 X 3/4	3/4 X 1/2
3-3/8 TO 3-3/4	7/8 X 7/8	7/8 X 5/8
3-7/8 TO 4-1/2	1 X 1	1 X 3/4
4-3/4 TO 5-1/2	1-1/4 X 1-1/4	1-1/4 X 7/8
5-3/4 TO 6	1-1/2 X 1-1/2	1-1/2 X 1



METAL GAGES H

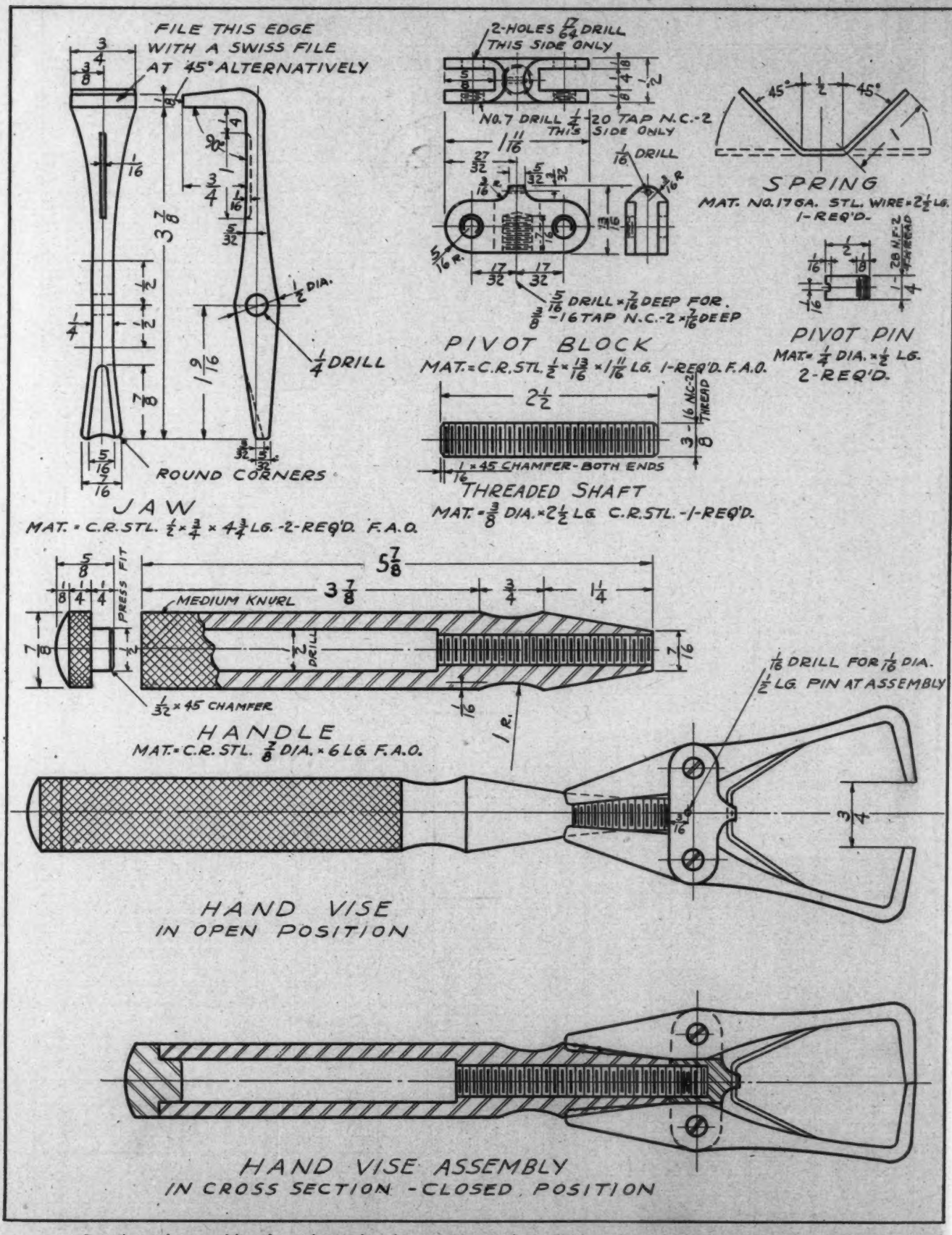
NUMBER OF GAGE	AMERICAN OR BROWN & SHARPE AWG	WASHBURN & MOEN WMG	BIRMINGHAM OR STUBS IRON WIRE BWG	U.S. STANDARD FOR PLATE USG
7-0	——	.4900	——	——
6-0	.5800	.4615	——	——
5-0	.5165	.4305	.500	——
4-0	.4600	.3938	.454	——
3-0	.4096	.3625	.425	——
2-0	.3648	.3310	.380	——
0	.3249	.3065	.340	——
1	.2893	.2830	.300	——
2	.2576	.2625	.284	——
3	.2294	.2437	.259	.2391
4	.2043	.2253	.238	.2242
5	.1819	.2070	.220	.2092
6	.1620	.1920	.203	.1943
7	.1443	.1770	.180	.1793
8	.1285	.1620	.165	.1644
9	.1144	.1483	.148	.1495
10	.1019	.1350	.134	.1345
11	.0907	.1205	.120	.1196
12	.0808	.1055	.109	.1046
13	.0720	.0915	.095	.0897
14	.0641	.0800	.083	.0747
15	.0571	.0720	.072	.0673
16	.0508	.0625	.065	.0598
17	.0453	.0540	.058	.0538
18	.0403	.0475	.049	.0478
19	.0359	.0410	.042	.0418
20	.0320	.0348	.035	.0359
21	.0285	.0317	.032	.0329
22	.0253	.0286	.028	.0299
23	.0226	.0258	.025	.0269
24	.0201	.0230	.022	.0239
25	.0179	.0204	.020	.0209
26	.0159	.0181	.018	.0179
27	.0142	.0173	.016	.0164
28	.0126	.0162	.014	.0149
29	.0113	.0150	.013	.0135
30	.0100	.0140	.012	.0120
31	.0089	.0132	.010	.0105
32	.0080	.0128	.009	.0097
33	.0071	.0118	.008	.0090
34	.0063	.0104	.007	.0082
35	.0056	.0095	.005	.0075
36	.0050	.0090	.004	.0067
37	.0045	.0085	——	.0064
38	.0040	.0090	——	.0060
39	.0035	.0075	——	——
40	.0031	.0070	——	——

USES OF VARIOUS GAGES J

	AWG	WMG	BWG	USG
ROD	ALUMINUM BRASS COPPER			
SHEET	ALUMINUM BRASS COPPER PHOS. BZ			HOT & CRS GALV. & BLACK IRON BLUE ANNEALED STEEL HR IRON
STRIP			HOT & CR STRIP HOT & CR BANDS SPRING STEEL	
TUBE			AL. BR, COP. SEAMLESS & STAINLESS BOILER.	
WIRE	ALUMINUM BRASS COPPER RESISTANCE	GALVANIZED & ANNEALED STEEL IRON SPRING STEEL	FLAT TELEPHONE & TELEGRAPH	

MACH. HANDBOOK CENTRAL STEEL & WIRE CO. RIVERSIDE STEEL CO.

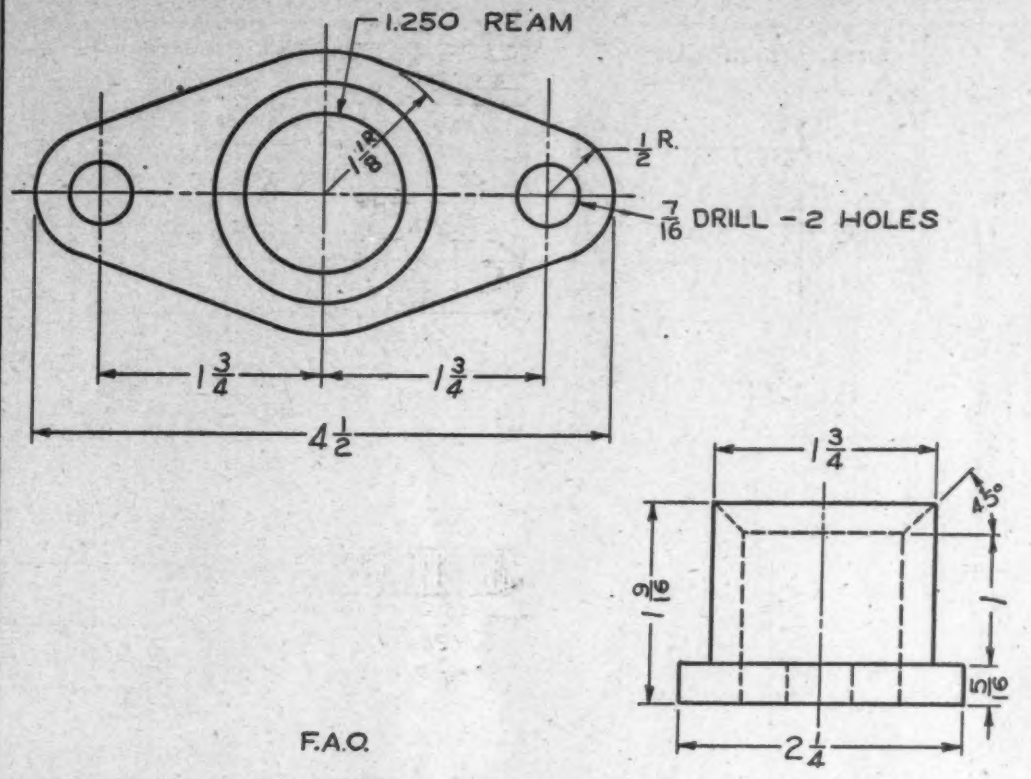
Data table for drafting room by H. D. Campbell, Cicero, Ill.


FILE THIS EDGE WITH A SWISS FILE AT 45° ALTERNATIVELY
ROUND CORNERS
JAW
MAT. = C.R.STL. 1/2 × 3/4 × 4 3/4 LG. -2-REQ'D. F.A.O.
2-HOLES 17/64 DRILL THIS SIDE ONLY
NO.7 DRILL 1/4-20 TAP N.C.-2 THIS SIDE ONLY
PIVOT BLOCK
MAT.=C.R.STL. 1/2 × 13/16 × 1 11/16 LG. 1-REQ'D. F.A.O.
SPRING
MAT. NO.17GA. STL. WIRE × 2 1/2 LG.
1-REQ'D.
PIVOT PIN
MAT.= 1/4 DIA. × 1/2 LG.
2-REQ'D.
THREADED SHAFT
MAT. = 3/8 DIA. × 2 1/2 LG. C.R.STL. -1-REQ'D.
1/16 × 45 CHAMFER - BOTH ENDS
HANDLE
MAT. = C.R. STL. 7/8 DIA. × 6 LG. F.A.O.
MEDIUM KNURL
PRESS FIT
1/32 × 45 CHAMFER
1/16 DRILL FOR 1/16 DIA. 1/2 LG. PIN AT ASSEMBLY
HAND VISE IN OPEN POSITION
HAND VISE ASSEMBLY IN CROSS SECTION - CLOSED POSITION

Details and assembly of machinist hand vise submitted by Nathan Bogoch, Winnipeg, Man., Can.

Job. 17. Draw the front view of the gland.

Purpose: To teach the reading of a front view.



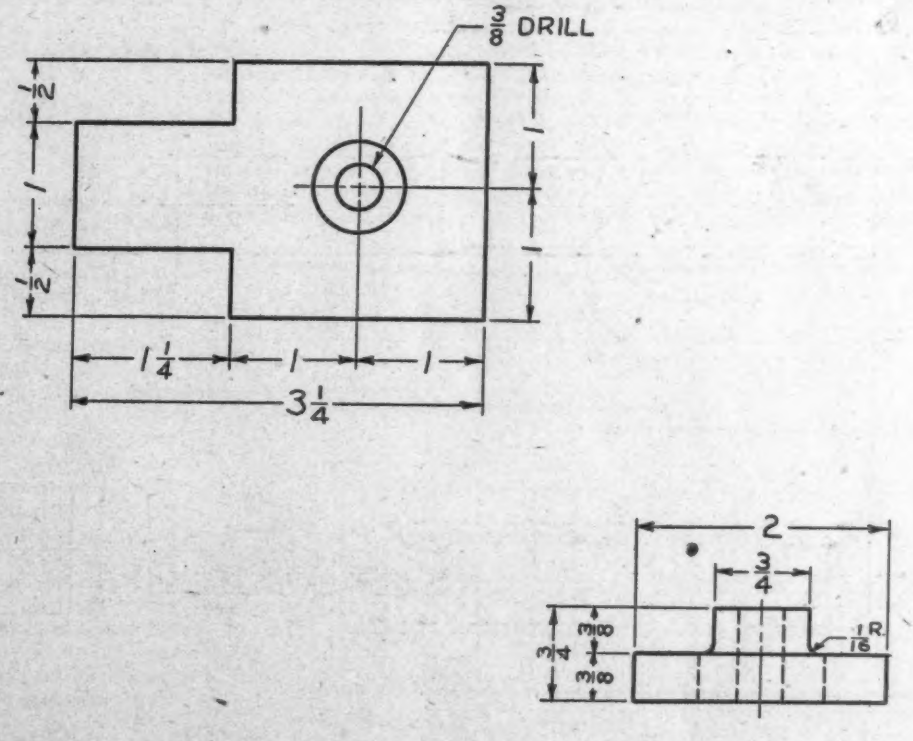
F.A.O.

Your Name

Date Completed

Job. 16. Draw a front view of the door catch.

Purpose: To teach the reading of a front view.

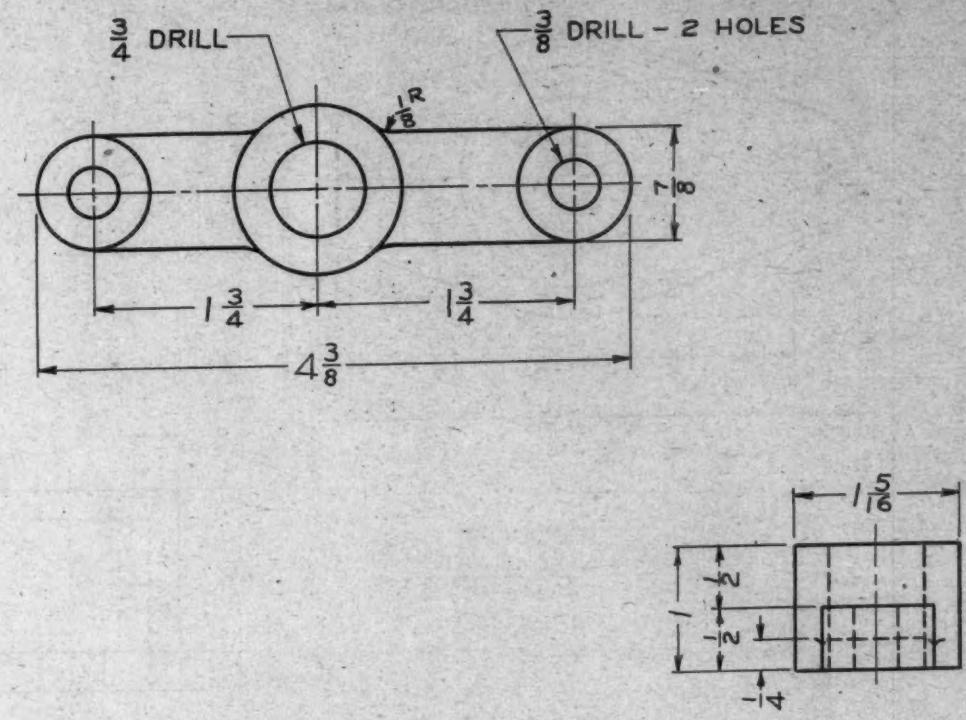


Your Name

Date Completed

Job 19. Draw a front view of the link bearing.

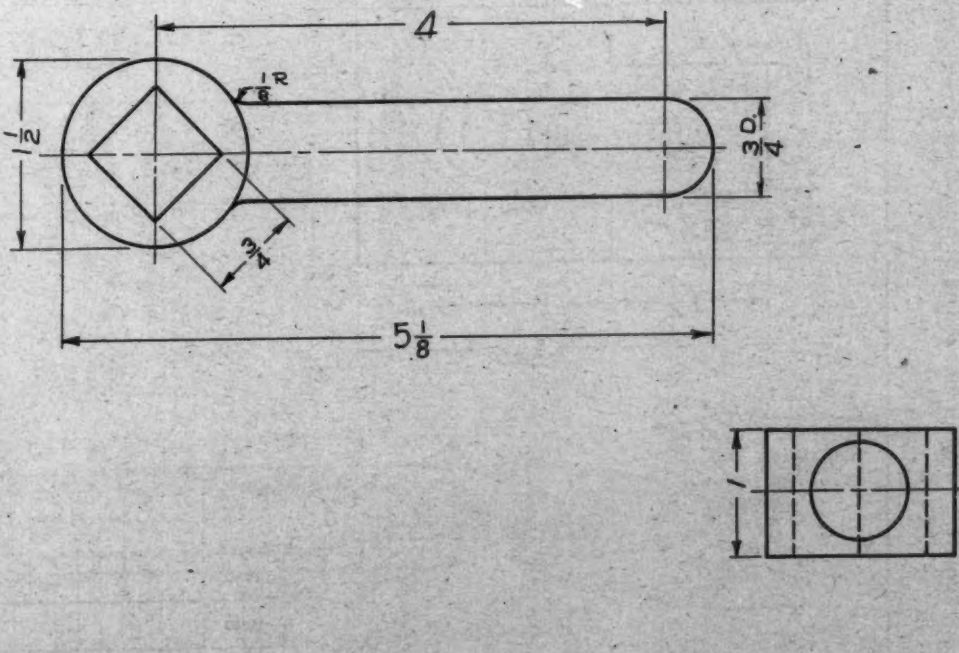
Purpose: To teach the reading of a front view.



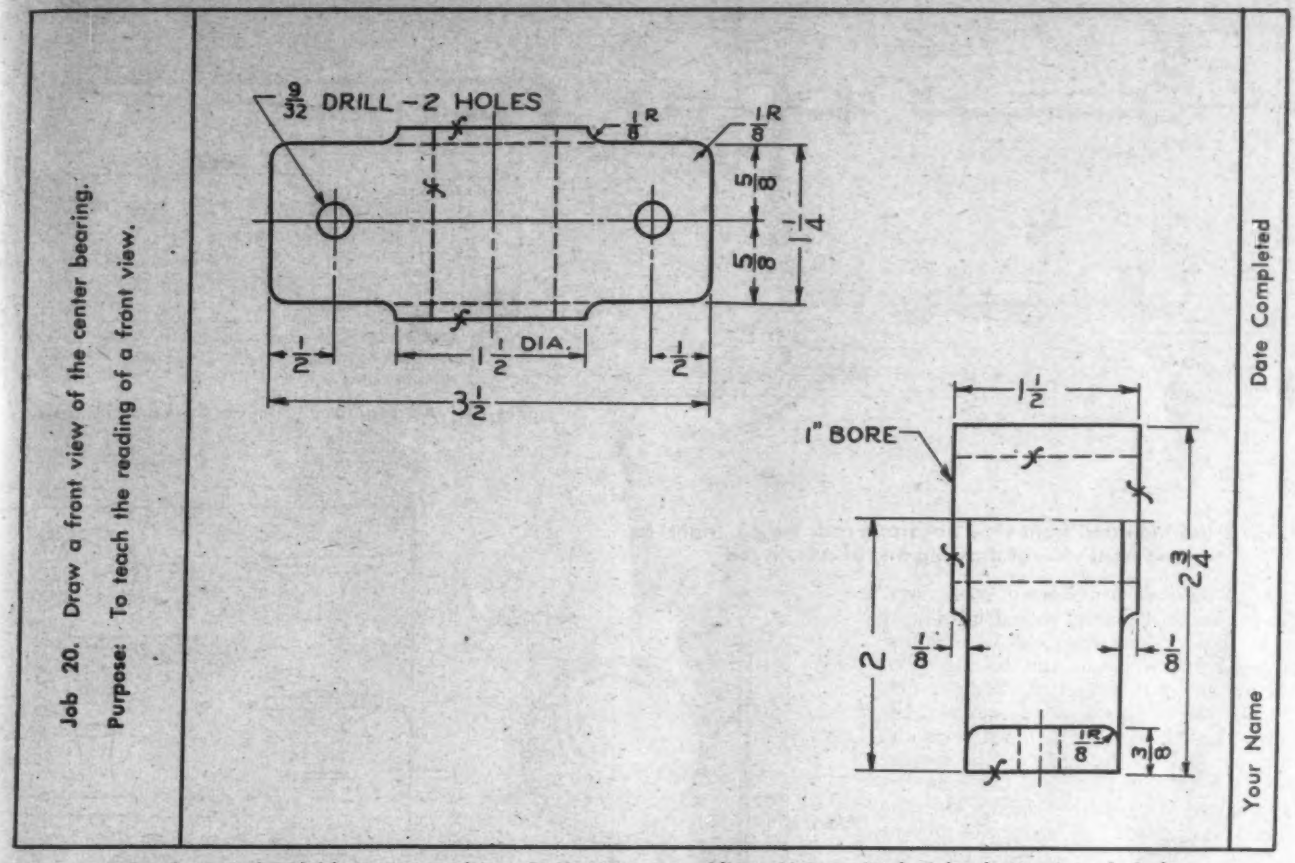
Your Name Date Completed

Job 18. Draw a front view of the closed head wrench.

Purpose: To teach the reading of a front view.



Your Name Date Completed



Fundamentals of blueprint reading. C. H. Niemann, Oliver Morton High School, Hammond, Ind.

TO DARKEN THE CLASSROOM

D. F. SCHUTTE

Director of Visual Education
Public Schools
Red Wing, Minn.

One of the principal problems in adapting a room for the use of projected visual materials is that of room darkening. A very satisfactory solution to the darkening problem can be achieved by the use of sliding drapes.

Drapes offer additional advantages over other methods of darkening. They add needed acoustical damping, thereby promoting better sound reproduction. They also provide an efficient method of darkening because they shut out more light than many other darkening arrangements and devices. Besides all this, they permit more adequate window ventilation as they allow air to enter and leave the room from above and below the drape. They are simple to operate, and save time by eliminating the necessity of pulling numerous shade cords to darken the room. An additional advantage of drapes is that they last for a long time with relatively little replacement and repair costs

Black denim makes perhaps the most satisfactory darkening drapes, although other kinds of black material often prove quite suitable. The drapes should be large enough so that they will extend four inches below the window-sill level. The length of the drapes should allow for about a foot and a half overlapping at the middle where the two sections meet. The hooks on which the curtain hangs should be riveted to the upper edge of the curtain, about four inches down from the top edge of the curtain, as shown in Figure 5. The hooks should be spaced about a foot apart.

To mount the curtains, two lengths of ¾-in. iron pipe can be attached to the side wall or ceiling by means of a flange bushing and elbow, as illustrated in Figure 1. Before assembling the pipes and attaching

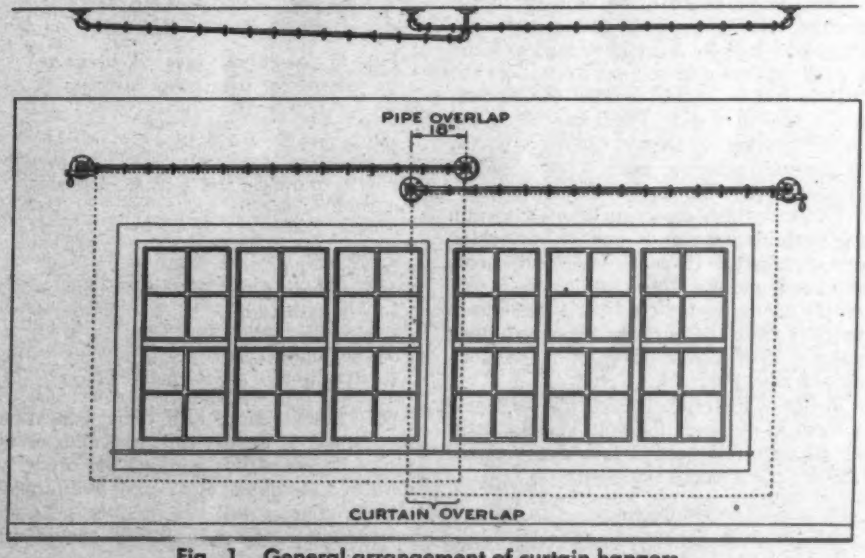


Fig. 1. General arrangement of curtain hangers

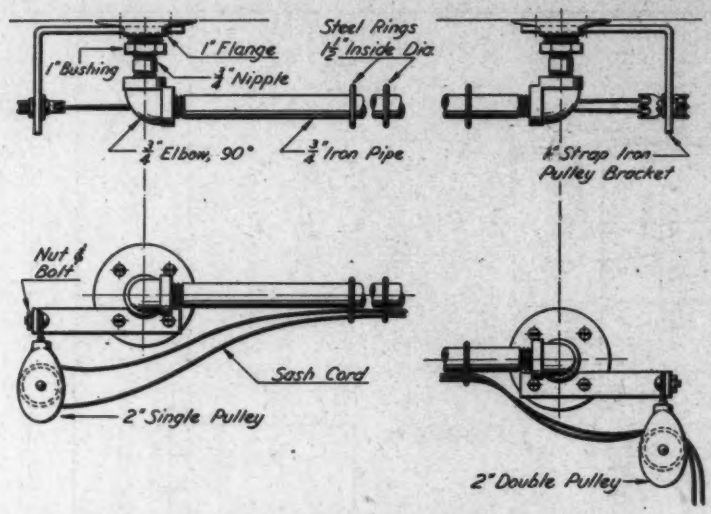


Fig. 2 (left) top and front view of curtain rod. Fig. 3 (right) top and front view of drawing and of curtain rod

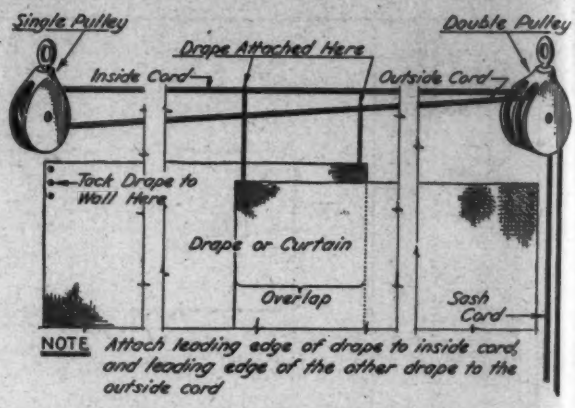

Single Pulley
Drape Attached Here
Double Pulley
Inside Cord
Outside Cord
Tack Drape to Wall Here
Drape or Curtain
Overlap
Sash Cord
NOTE Attach leading edge of drape to inside cord, and leading edge of the other drape to the outside cord

Fig. 4. Arrangement of cords for hanging drape

them to the wall, a number of steel rings, 1½ in. inside diameter, should be slipped on the pipe. These rings can be obtained at any harness or tent and awning shop. The number of rings needed will depend on the number of hooks on the curtain, because these hooks are snapped onto the rings to hold up the curtain. The curtain need not be attached until the pipe has been affixed to the wall or ceiling. The pipe should be mounted high enough to prevent a crack of light from entering the room from above the curtain. The two sections of pipe should overlap each other by about 1½ ft. at the middle of the room, and one of the pipes should be set out about 1 in. from the other to allow clearance for the rings to slide on the pipe, thereby permitting the curtains to overlap when drawn.

A 2-in. pulley is needed at each end of the pipe to hold the cord which pulls the curtain open and closed. At the back end of the room a single pulley is used, and a double pulley at the front end, as shown in Figures 2 and 3. A bracket made of the 1-in. strap iron can be used to support the pulleys just below the level of the pipe on which the rings slide. Holes can be drilled in the bracket so that it can be attached to the wall with the same screws used to attach the pipe flange to the wall.

Ordinary sash cord can be used to pull the curtains open and shut. By attaching one curtain 1½ ft. past center to the outside cord, and the other curtain 1½ ft. past center on the inside cord, it is possible to open or close the curtains by only pulling one strand of cord at the front of the room, as shown in Figure 4.

A list of materials needed for darkening a room as outlined, follows: The total cost of all materials needed should not exceed $50 for the average classroom.

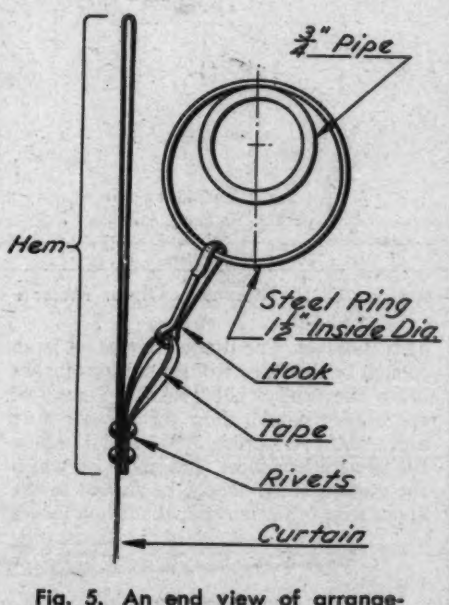
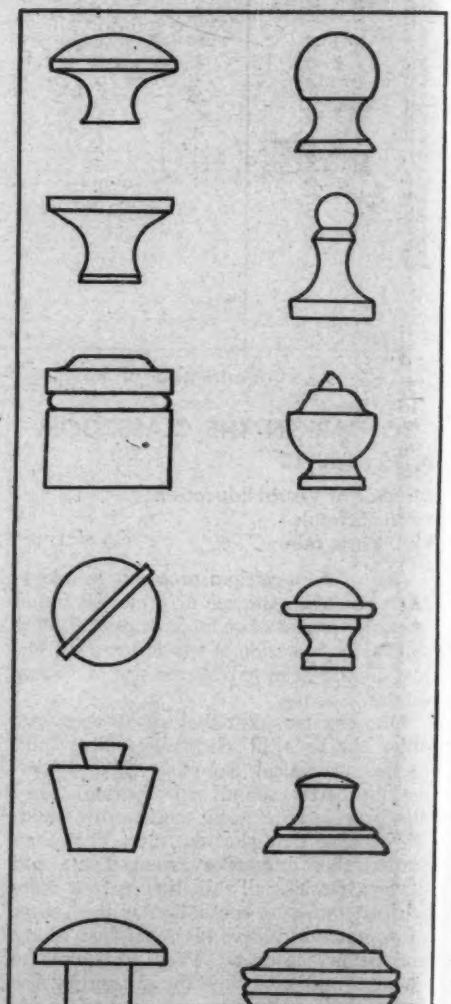


Fig. 5. An end view of arrangement for attaching curtain

Materials

2 sections dark curtain (should overlap sill at top and bottom by 4 in., at ends by 1 ft., and in middle by 1½ ft.)
2 sections iron pipe (¾ in., should overlap 1½ ft. in middle and 1 ft. at each end.)
4 nipples, ¾ in.
4 flanges, 1 in.
4 elbows, ¾ in., 90 deg.
4 bushings, 1 in.
30–40 steel rings, 1½ in. inside dia.
60–75 ft. sash cord
1 single pulley, 2 in.
1 double pulley, 2 in.
3 ft. strap iron, 1 in., for pulley brackets

The first essential in a visual education program is to have a sufficient number of rooms darkened, for without the properly darkened rooms the most expensive projection equipment will not produce satisfactory results. General room light should not exceed 1/10 of a foot-candle.



Knob designs suitable for powder and cigarette boxes, and for humidors. Designed by Harold S. Beal, East Rochester, N. Y.

LEG REST

LYLE M. GARNETT
Milwaukee Vocational School
Milwaukee, Wis.

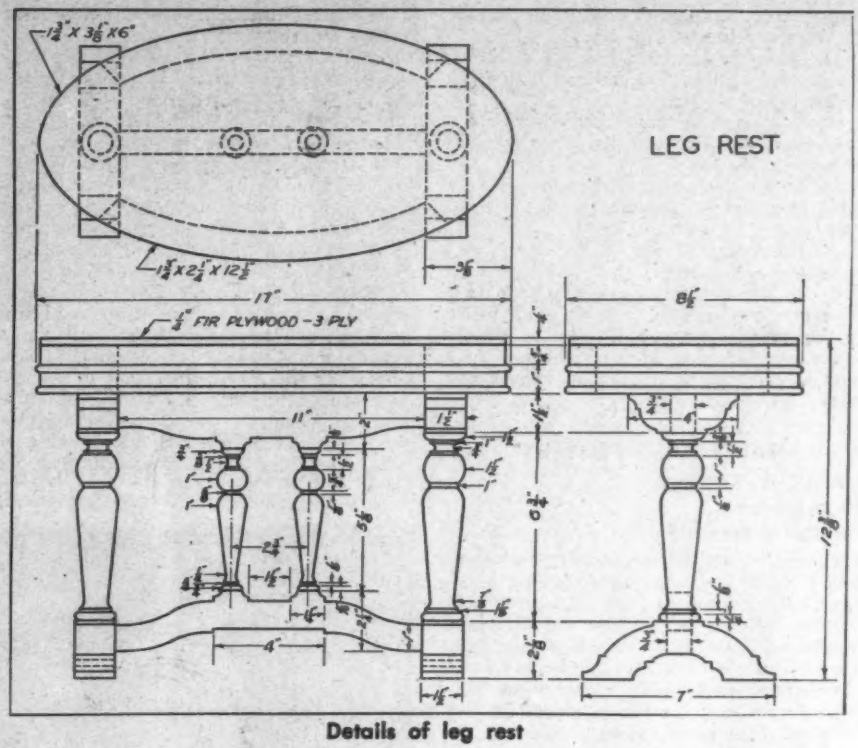
Purpose:

1. To make a footstool or leg rest.
2. To use clamp nails.
3. To make an eliptical-shaped top for the leg rest.

Technical Information:

This leg rest is made somewhat higher than the ordinary footstool. It is high enough so that when a person is sitting in an arm chair it is possible to place the feet atop this rest and stretch out as if in a lounging chair.

Leg rest



Details of leg rest

The spindle turnings for the base should have a tenon cut on each end to go into the top piece and into the shoe at the bottom. This tenon should be about ⅝ in. in diameter and should be at least 1 in. long. The dowel from the stretcher should be a ⅜-in. dowel and should be placed into the upright piece after the spindle is glued to the shoe. This will have a tendency to act as a pin through the tenon and will aid in holding the joint together.

Bill of Material

No. of pieces	*Name of part*	*Size*
2	Shoe	1½ x 2⅜ x ?
2	Spindle	1½ x 1½ x ?
2	Top piece	1½ x ? x ?
1	Stretcher	¾ x ? x ?
1	Top cross bar	¾ x 2 x ?
2	Center spindle	1 x 1 x ?
2	End of ellipse	1¾ x 3⅜ x 6
2	Side of ellipse	1¾ x 2¼ x 12½
1	Upholstering board	¼ x 8½ x ?

Tools and Machines:

Circular saw, band saw, hammer, upholstering tools, lathe, shaper, lathe tools, backsaw, auger bits ⅜–⅝ in.

Construction Procedure:

1. Select the type of material to be used in constructing this foot rest. A piece of furniture such as this will get considerable hard usage and it would be best to construct it of one of the harder materials.

2. Complete the stock bill taking the finished dimensions from the drawing.

3. Cut the stock to the rough dimensions. In this instance the four pieces to be used for the turnings should be cut rough and then turned while the other pieces, except those for the top frame, should be cut to dimensions later. When roughing out the material make the pieces ½ in. wider than the stock bill asks for and make them 1 in. longer.

4. Place the spindles in the lathe one at a time and turn them to the pattern and the sizes indicated on the drawing.

5. Lay out the patterns for the end pieces and the stretchers on a heavy piece of paper.

6. Plane the pieces to the correct width and thickness but leave the end pieces the original rough length. Cut the stretchers to the correct length.

7. Lay the pattern on the separate pieces of stock. Use a very sharp hard pencil for this operation.

8. Lay out the position of the centers of the dowel holes in the stretchers and in the end pieces.

9. Bore the dowel holes the correct diameter and depth.

10. Band saw the pieces to the desired shapes.

11. Sandpaper the surfaces of the pieces with at least two grades of sandpaper and make all surfaces as smooth as possible.

12. Glue the spindles to the end pieces and allow the glue ample time to dry.

13. Lay out the ellipse for the top on a piece of heavy paper. Indicate the joints at each of the four points on the elipse.

14. Miter the pieces to form the ellipse. The dimensions for this may be taken from the full-size layout.

15. Place the pieces together and indicate where the saw kerfs are to be made for the clamp nails.

16. Make a saw kerf as deep as one half the width of the clamp nail used for this joint.

17. Nail the four pieces together with the aid of the clamp nails. Use either one nail long enough to go all the way through the stock or use two short nails and drive them in from each side of the joint.

18. Glue the center section of the footrest together by gluing the small spindles to the stretchers. Allow the glue joints ample time to dry before any other operation is performed on this portion of the footrest.

19. Lay out the ellipse on the frame held together with the clamp nails.

20. Band saw this frame to the elliptical shape necessary.

21. Smooth the edges of this frame as nearly perfect as possible. Be sure to follow the lines very closely since any irregularity is so easily seen on this shape of top.

22. Set the shaper for a bead cut and make the cuts around the edge of the top.

23. Complete the molding for the top by placing a straight knife of the proper width in the shaper and again making the cuts around the edges of the top. A band of inlay may be set into the stock at this time should it be desired. This band will go between the two beads.

24. Complete the assembly of the lower section of the footrest by gluing the center section to the end sections.

25. Locate two dowel holes in the top of the end sections and bore two ⅜-in. holes at these points. Make these holes as deep as possible without having the point of the bit come through the material where it will show.

26. Place dowel centers in these holes, place the top section on the bottom section in the proper place, and tap on the top of the frame so as to make an impression with the center point of the dowel centers.

27. Bore the dowel holes in the bottom surface of the top frame.

28. Glue the two sections together. It may not be possible to hold these sections together with glue clamps. It is possible to apply the glue to the joints, press them together by

hand, and set the project aside while the glue on the joints has time to dry.

29. Make the piece of three-ply stock for the padding of the stool and nail it in place on the top of the frame.

30. Sandpaper the entire project with fine sandpaper. Be sure to make all surfaces as smooth as possible.

31. Finish the piece of furniture with a finish that will be suitable for the material used.

32. Upholster the top of the frame with some piece of material that will harmonize with the rest of the footrest. This padding is done over the piece of three-ply stock nailed to the top of the frame. Be sure to pull the cover over the edges of the frame and use a narrow gimp to finish off the upholstering work.

HAND-BUILT POTTERY

EDGAR H. STRONG
High School
Geneva, New York

Ceramic work in the school shop program may include a number of different forming processes. The number and variety of these activities depend on the kind and amount of equipment in the shop and the preparation of the instructor. Of the various ceramic forming processes, hand building presents the most logical starting point for industrial-arts students who are beginning work with clay as a material.

Hand building requires fewer materials than any other forming process and requires no tools other than the fingers. It is the best way to introduce the student to the nature and physical behavior of clay as a material for the construction of pottery forms. The clay used is in the plastic state which is its most familiar state. Since the student is not diverted by unfamiliar tools he can concentrate on the manipulation of his material. He learns to control the material and to create a useful product from a shapeless mass of raw clay.

After learning the basic steps in the manipulation of plastic clay, the student will be able to build well formed and durable pottery in an infinite variety of shapes and sizes. These pieces may range from small ash trays to large vases, bowls, and pitchers. All hand-built pottery will show the characteristic marks left by the fingers in the building. These marks may be removed by scraping, but they do not need to be if the building has been done carefully. The characteristic marks left by the fingers on a hand-built piece, combined with a carefully selected and well-applied glaze, result in pottery having a jewellike quality which cannot be produced by any other building method.

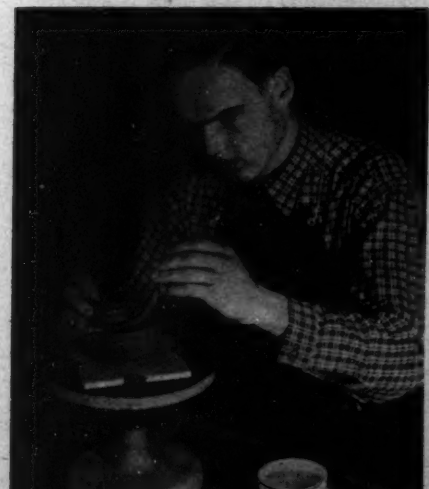


Fig. 1. Hand-built pottery

The simple equipment needed for hand building includes a 6 by 6-in. shellacked board or biscuited tile, sponge, water cup, and a boxwood modeling tool. It is desirable to have a revolving wheel head or spinner so that the work can be turned easily without excessive handling. A suitable spinner can be made of wood with a 9-in. plywood disk, a piece of ½-in. dowel, and a heavy wooden base. See Figure 1.

Fig. 2

Before beginning any ceramic forming process the clay must be properly prepared. In hand building, the plastic clay is brought to the proper working consistency by cutting the clay on a taut wire and throwing the cut halves together on a moist plaster slab or wedging table. The clay may need to be moistened slightly since it must be moist enough to be rolled into thin coils easily and without showing cracks. The wedging operation equalizes the consistency of the clay and releases entrapped air.

To form the base, a piece of clay is rolled between the hands to form a round ball. If the finished base disk is to be 3 in., the ball should be about 1½ in. in diameter. See Figure 2.

Place the ball of clay in the center of the tile which has been thoroughly moistened and attached to the spinner with four scraps of clay. Strike the ball of clay uniform light blows with the edge of the right hand, as shown in Figure 3, and with the left hand turn the spinner slowly and uniformly so that the clay ball is flattened into a perfectly round disk about ⅜ in. thick. If the ball of clay was round and the strokes of the hand were uniform and correctly spaced, it should be unnecessary to trim or cut the base disk.

Take a piece of clay about half the size of the piece used for the base disk and roll it into a round ball. Begin to roll it into a cylinder

Fig. 3

between the hands, keeping the pressure light and rolling the cylinder clear across the hands from fingertips to the heel of the hand. When the cylinder is longer than the width of the hands, lay it on a smooth moist table top, as shown in Figure 4, and roll it lightly with both hands. Place the hands with the fingertips together and the heels spread wide. Roll all the way across the hands so that the coil of clay makes several revolutions with each passage of the hands. The coil should be rolled to a diameter about twice the thickness that you want the finished wall to be.

Fig. 4

When the coil has been rolled to a uniform diameter of about ⅜ in., pinch off one end so that the ends of the coil will overlap where they are joined. Moisten the edge of the disk upon which the coil will be laid and put the first coil in place. The clay should be pressed down against the pinched-off end and the excess length broken off. See Figure 5. All surfaces of clay to be joined should be moistened and pressed firmly together. Check the first coil for roundness and then tap it down lightly with the finger to seat it onto the moistened surface of the base disk.

Fig. 5

The second coil is rolled and put in position directly above the first except that the joints are staggered. Remember to moisten the top of the first coil before placing the second in position. After checking the second coil for roundness, tap it down to seat it properly and to slightly flatten the top surface. See Figure 6.

Fig. 6

After two coils are in position, they are welded to each other and to the base disk. Place the middle finger of the left hand behind the wall, the index finger on top of the wall, and with a dry fingertip of the right hand pull a little of the clay from the top coil across the first coil, across the edge of the base and down onto the tile, as shown in Figure 7. Weld the coils all the way around the piece. Keep the tip of the finger dry and do not moisten the clay.

Fig. 7

To weld the inside of the coils place the middle finger outside the wall, at the back of the piece, the index finger on top, and pull clay from the top coil over the first coil and out onto the base disk. See Figure 8. Careful welding of the inside of the first two coils will insure a smooth transition of wall to base.

Each successive coil after the first two is welded to the preceding one as soon as it is put in place.

After each five or six coils are laid and welded, it will be necessary to allow the clay to stiffen somewhat to provide a strong base to support additional construction. Thirty to forty-five minutes will be sufficient if the piece is left out in the open air of the room and if time will allow for more coils to be added. If the work is to be left until the next working period, it should be placed in a damp storage compartment or covered with a moist cloth. Moist clay cannot be added successfully to a clay wall that has partially dried out. When a

Fig. 8

piece has dried past the leather-hard stage, enough shrinkage will have taken place to make it impossible to add moist clay safely.

The shape of the piece of pottery to be built will determine how the coils should be laid. If the walls are to flare out, each successive coil should be slightly larger than the

Fig. 9

last one so that it will not be necessary to stretch the walls. If the walls are to curve inward, each successive coil should be slightly smaller than the last one. Minor corrections in the profile can be made by molding the wall as it is being checked for conformation to the template, but the building should result in a pottery form closely approaching the desired shape.

Before each new course of five or six coils is added, the previous construction should be

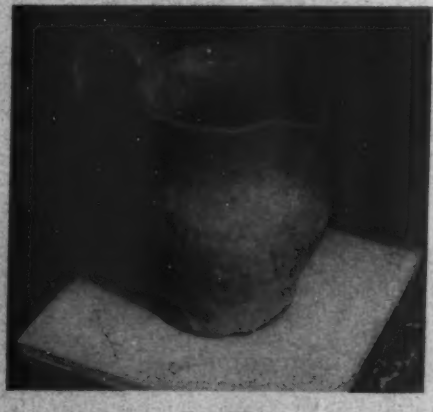


Fig. 10

pinched up to equalize the wall thickness and to smooth the wall inside and out. Pinching should be done by using the thumb and forefinger with uniform pressure and following a uniform pattern around the piece before raising the fingers to the next higher level. As the moist clay flows under the pressure of the thumb and forefinger, the walls will become thinner and will rise slightly. Corrections can be made in the top of the piece to provide a level base on which to lay the first coil of the new construction. The profile of the piece should be checked with a template and made to conform to the proposed shape before additional coils are put in place.

When the piece is completed, the final five or six coils should be pinched up carefully to insure the proper wall thickness and an accurate rim. The opening should be checked for roundness and adjusted while the clay is still flexible. Excess clay should be cut away where the foot joins the tile so that the pottery piece will free itself from the tile easily.

When the clay is leather hard (moist but stiff enough to be handled without deformation), the piece is freed from the tile and turned over. Hollow out the base slightly, leaving a rim or foot about ¼ in. wide so that the pottery piece will set on this narrow rim and clear the table at the center. Round the edge of the base by scraping with a potter's knife and smooth it with a moist sponge.

If handles are to be added, they should be put in place while the clay is leather hard. Handles are made of plastic clay coils, left round or flattened and applied to the moist clay surface using clay slip as an adhesive. The handle should be carefully welded to the body of the piece at each point of contact. After the clay has stiffened slightly, the handle can be adjusted so that it will conform exactly to the desired shape.

If a pitcher is being made the lip can be built out as the coils are laid, or it can be cut from a flat sheet of plastic clay and attached when the piece is leather hard. See Figure 10.

Hand-built ware looks best when it is glazed with transparent glazes which allow the body to show through. The glazes must be applied carefully to insure complete coverage and uniform thickness.

LAPEL PIN — DOG

ABRAHAM G. BELESON

The Bronx High School of Science
New York City, N. Y.

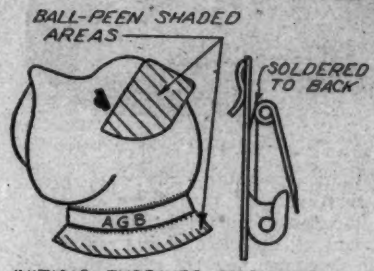
This pin can be made out of copper, brass, aluminum, silver, or gold. It can be made with the following tools: pencil, tin snips, file, jeweler's saw, hand drill, and ⅛-in. drill, steel wool, buffing compound (if polishing head is available), buffing wheels, engraving tool, and 6-oz. ball-peen hammer.

Procedure

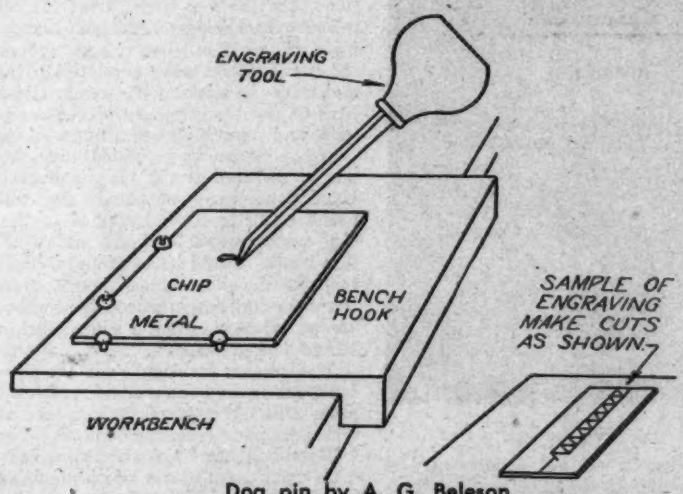
1. Select a 2 by 3-in piece of metal.
2. Lay out or trace pattern.
3. Cut to shape with jeweler's saw and snips.
4. File edges smooth.
5. Drill hole for eye with ⅛-in. drill.
6. Cut slot for eye with jeweler's saw.
7. Lay out design or initials for collar.
8. Engrave design or initial (see information on engraving).
9. Solder safety pin to back. If safety clasps are available use a safety clasp.

10. Clean pin with fine steel wool.
11. Buff with tripoli.
12. Buff with rouge.
13. Decorate ear and bottom of neck with ball-peen hammer.
14. Bend ear in place.
15. Bend jaw in place.

DESIGN ON COLLAR



INITIALS ENGRAVED ON COLLAR
PIN DIPPED IN CLEAR LACQUER
FOR PERMANENT FINISH



Dog pin by A. G. Beleson

Information on Engraving

There are many types of engraving tools. For beginners I suggest the flat engraving tool. Before doing any engraving on your work, try it out on scraps of metal.

Hold handle firmly and wiggle the wrist. The angle of the tool varies with the individual. The greater the angle of the tool, the deeper the cut. Make light cuts until you have more skill in the use of the engraving tool.

THE ART OF GETTING ALONG

EDWARD C. ESTABROOKE
American School
Chicago, Ill.

Sooner or later, a man, if he is wise, discovers that life is a mixture of good days and bad, victory and defeat, give and take. He learns that it doesn't pay to be a sensitive soul; that he should let some things go over his head like water off a duck's back.

He learns that he who loses his temper usually loses out. He learns that all men have burnt toast for breakfast now and then, and that he shouldn't take the other fellow's grouch too seriously. He learns that carrying a chip on his shoulder is the easiest way to get into a fight, and the quickest way to become unpopular is to carry tales and gossip about others.

He learns that buck passing always turns out to be a boomerang, and that it never pays. He comes to realize that the school could run along fairly well without him. He learns that it doesn't matter so much who gets the credit so long as the job gets done.

He learns that all people are human and that it doesn't do any harm to smile and say "Good Morning," even if it is raining. He learns that most of the other fellows are as ambitious as he is, that they have brains that are as good or better, and that hard work and not cleverness is the secret of success. He learns to sympathize with the youngster coming into the profession because he remembers how bewildered he was when he first started out.

He learns not to worry when he makes a blunder because experience has shown him that if he always gives his best, his average will break pretty well. He learns that no man ever got to first base alone, and that it is only through co-operative effort that we move on to better things. He learns that bosses are not monsters, trying to get the last ounce of work out of him for the least amount of pay, but that they are usually fine men who have succeeded through hard work.

He learns that folks are not any harder to get along with in one place than another, and that the *getting along* depends about 99 per cent upon his own behavior.

CASTOLITE PROJECTS IN THE INDUSTRIAL-ARTS SHOP

WILLIAM WEERS
Kenilworth, Ill.

The liquid plastic called Castolite was first made available about two years ago. It is now being used extensively in the classroom and by many home craftsmen. Mr. Alexander F. Bick had an article on this plastic on page 376 of the October, 1946, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. Since that time many new projects have been offered by teachers, students, and individual home craftsmen. This is natural since few materials offer such fine opportunities for inventive skill in the field of design, decoration, and utility.

The shaping and machining of conventional thermoplastics is well established and many attractive and useful items have been produced in school shops. The Castolite method has the advantage of combining the technique of chemistry with the industrial arts. Teachers from all parts of the country and several schools in foreign lands report enthusiastic interest on the part of the student, especially in the casting operation where he can watch the conversion from a light syrupy substance to a hard, clear, transparent plastic.

For successful use, it is well to follow the ten basic steps of the Castolite method described herewith:

1. Prepare a working area. Protect table with newspaper.
2. Assemble the materials and equipment.
3. Measure the liquid Castolite.
4. Add the hardener.
5. Mix the hardener and Castolite.
6. Fill the mold.
7. Thicken the liquid.
8. Cure the plastic.
9. Remove the piece.
10. Shape and finish the object.

The foregoing order forms the basis for a clear mental picture of the method by which Castolite plastics are formed.

Casting a Rod

Let us consider how the steps are used to prepare a simple plastic rod.

Step 1. Protect the workbench with a newspaper.

Step 2. Assemble a supply of Castolite, hardener, medicine dropper, tablespoon, stirring rod, paper cup, glass test tube, pan of water, and thermometer (optional).

Step 3. Measure 3 tablespoonfuls of Castolite into the paper cup.

Step 4. Add 6 drops of hardener.

Step 5. Mix thoroughly with spoon or stirring rod.

Step 6. Pour the prepared Castolite into a glass tube.

Step 7. Place the tube (mold) in a pan of water at 120 deg. F. for five to fifteen minutes. By that time the liquid will be converted into a firm jelly. Remove the tube from the water

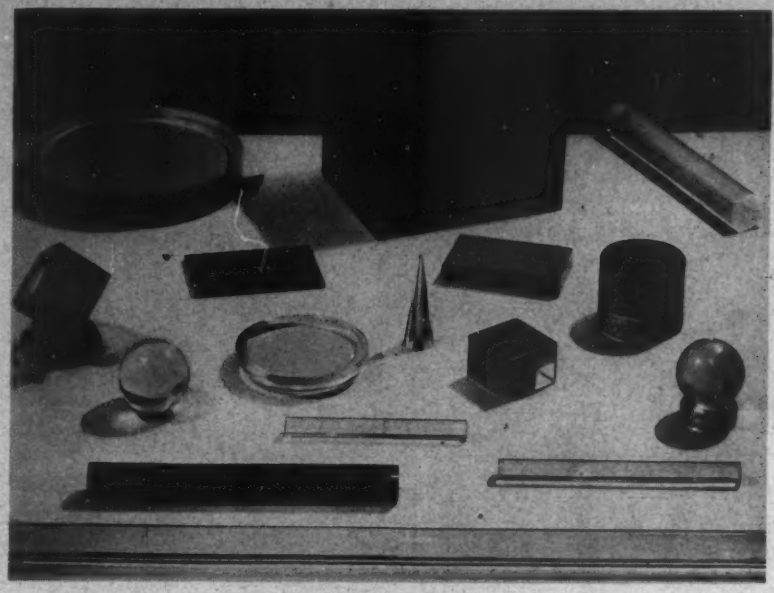


Fig. 1. Geometric shapes made out of Castolite

as soon as the Castolite has thickened and let it stand at room temperature for 30 minutes.

Step 8. Place the tube in a pan of water and heat the water to the boiling point. Boil for 25 minutes.

Step 9. Remove the tube and cool to room temperature and then shake the plastic rod from the tube.

Step 10. Fashion the casting into the desired article.

Casting Geometric and Other Shapes

Projects based upon the *ten basic steps* may be cast in many shapes. See the geometric shapes shown in Figure 1.

One of the most unique applications for Castolite is in the field of embedding objects in clear or dyed pieces. Such embedments may be made with:

1. Flowers, leaves, grass, and other botanical specimens.
2. Insects, such as beetles, bees, wasps, butterflies, dragon flies, spiders, etc.
3. Marine specimens, starfish, seahorses, sponges, pieces of coral, shells, etc.
4. Photographs. A colored picture embedded in a block of Castolite makes a very unusual book end.
5. Agricultural specimens, seeds, soils, pests, prize grains, pine cones, wood specimens.
6. Rocks, semiprecious stones, pebbles, lava, minerals.
7. Medical specimens, teeth, bones, tissue.
8. Metals, wire coils, lathe turnings, identification tags, military insignia.
9. Sportsmen's lore, fishing fly, animal horn, elk teeth, skeletons.

The embedding of flowers appears to be very popular with students, instructors, and home craftsmen. Prior to embedding the pansy shown in Figure 2, its color and shape were fixed by covering it with fine, clean sand for about seven days. Not all flowers need to go through this preparatory stage. Chrysanthemums and daisies, for example, will retain their color and shape much better when embedded in Castolite as soon as picked from the garden.*

The pansy shown in Figure 2 was embedded according to the following procedure:

Steps 1 and 2. In addition to the standard equipment and material already mentioned, a small glass custard cup is used for the mold.

Step 3. Measure 3 tablespoonfuls of Castolite.

Step 4. Add 12 drops of hardener.

Step 5. Mix well.

Steps 6 and 7. Pour enough of the prepared Castolite into the mold to cover the bottom. Place the mold in water at 120 deg. F. Watch carefully and in about 10 minutes the Castolite will be thick around the sides of the mold. Then place the pansy on the liquid, position it in the middle of the mold, and set the mold aside at room temperature until the pansy is held securely by the thick Castolite. This will take at least 30 minutes. Then pour in enough of the remainder of the prepared Castolite to cover the pansy at least ¼ in. Again place the mold in 120-deg. F. water for about ten minutes or until the second pouring has started to thicken. When it shows signs of thickening remove mold from the water and let it stand at room temperature for 30 minutes.

Step 8. Heat the mold in water at 150–160 deg. F. for 45 minutes. Remove from the water and cool to room temperature.

Step 9. During the curing process, the plastic has shrunk just enough to be released from the mold and usually falls right out.

Step 10. Castolite plastic is finished much like other plastics. It can be sawed, drilled, sanded, and polished. The shiny smooth surface of the custard dish gives the casting a brilliant finish. The exposed top surface requires a little sanding and polishing to obtain the same high luster.

Not the least of the value of the Castolite method in the classroom is the reference to the many practical applications which are suggested as the plastic is used. The wide range in the field of embedded objects permits the user of Castolite to employ many new techniques in design. One cannot always predict what new idea will come to a student after seeing a novel embedment of a highly colored, rare, or unusual part. Consider embedments for use in making pen holders, desk pen sets, book ends, picture frames, candleholders, paper weights, buttons, tiles, lamp bases, trays, necklaces, pins, wall plaques.

Coloring Castolite

Castolite is a clear and transparent liquid and it is very easy to mix special Castolite dyes and opaque pigments into the liquid. The dyed pieces have a sparkling, jewellike, transparent quality and the opaque pigments impart a satiny richness. Transparent dyes and opaque pigments are obtainable in white, yellow, green, blue, black, red, brown, purple, maroon, and orange.

A special fluorescent pink dye may be used

*Methods of dealing with a variety of flowers are described in a special bulletin dealing with the embedding of flowers in Castolite, published by The Castolite Co., Kenilworth, Ill.

Fig. 2. Flowers, coins, and the like embedded in Castolite

for unusually attractive, decorative applications. Phosphorescent pigments which glow in the dark are another effective media for creating unusual objects. Light and dark blue, green, and yellow-orange are the best of the phosphorescent colors. Pieces containing these pigments have interesting applications in making house numbers, summer cottage markers, exit signs, lamp bases, switch plates, etc.

Many unusual color effects can be given to Castolite pieces during the casting process. When the colors are not perfectly dispersed in the liquid Castolite, the effect is one of streakiness. Effects such as that of natural marble may be obtained. Similar effects are achieved by pouring two or more portions of different colors into the same mold. Checkerboard effects are used by converting one pouring to a jelly and adding a second or third pouring in a different color. Variations of opaque pigments with transparent dyes are likewise very unique.

A great deal has been accomplished in the development of Castolite. A lot still remains to be done, especially in the fixing of the colors of certain flowers and fruits. Extensive projects based upon the *ten basic steps*, called the Castolite method, will be published in the near future in book form.

LETTER HOLDER

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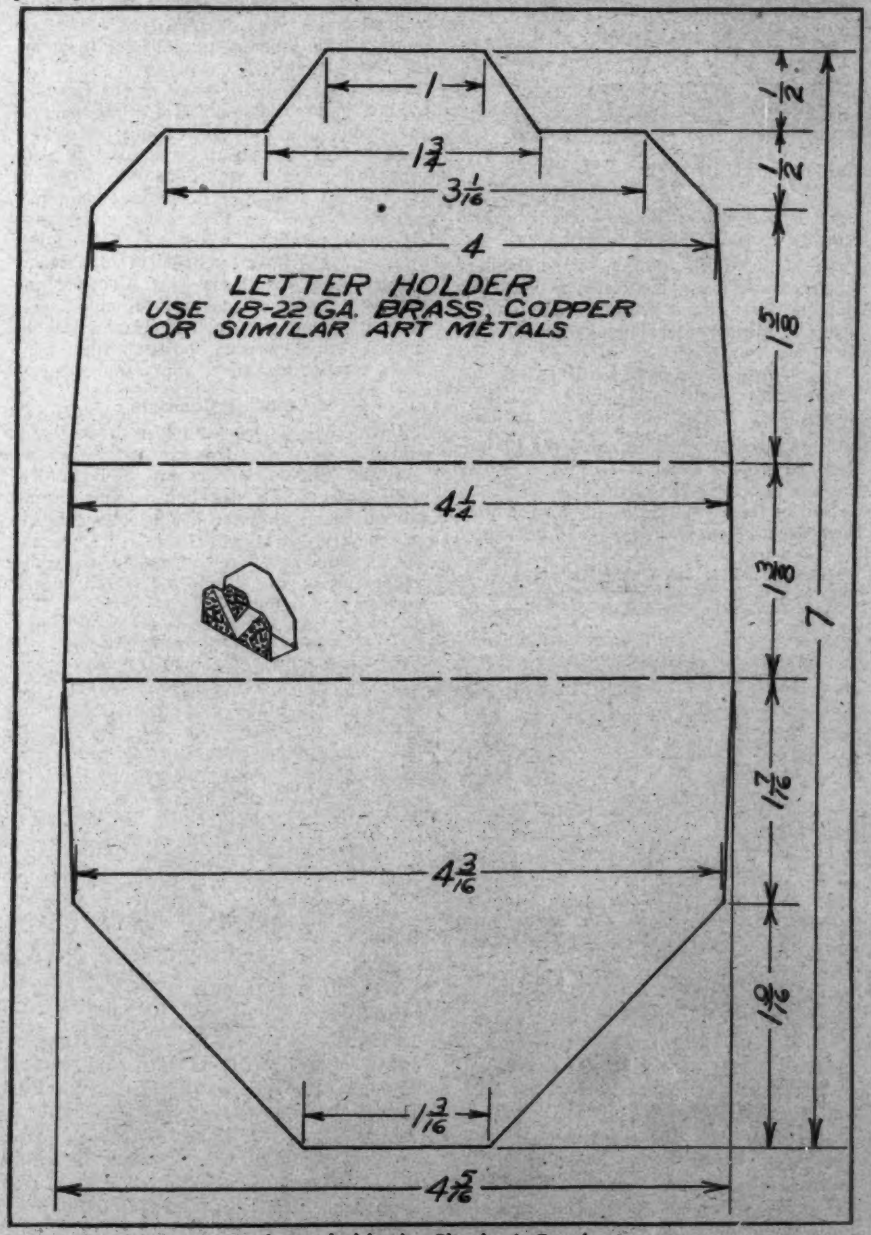
This project in art metalwork has received very favorable comments. The pattern provides for variations in decoration and finish. Possibilities include all-over hammered finish, V-pattern, scribed-line patterns from points to bottom center. Copper, brass, pewter, or any other metal of 18 to 22 gauge, not too soft, works well. This pattern has been used for a very effective clear plastic holder with scribed lines from all points to bottom center of front.

The following procedure will produce satisfactory results:

1. Lay out pattern and cut to shape.
2. Drawfile and smooth edges with fine abrasive cloth.
3. Polish surface with steel wool.
4. Lay out and apply decorative hammering.
5. Bend to shape. Use care to avoid marring surfaces.
6. Do the final polishing.
7. Apply clear lacquer.



Letter holder by Charles L. Frank

OUR LUMBER SUPPLY

Lyle F. Watts, chief of the forest service, United States Department of Agriculture, Washington, D. C., predicts that the present shortage of timber products will last for years to come.

In the past 36 years the nation's woodpile has been reduced by more than 40 per cent. The total stand of saw timber in the United States has been estimated at 2826 billion board feet in 1909 and is being shown by a nation-wide forest service study to be 1601 billion board feet at the present time.

Evidence of forest depletion today, he said, was to be found in every part of the country. Long before the war timber shortage had curtailed output in the older timber producing regions — New England, Pennsylvania, and the lake states. In 1946, shortages of pine timber big enough to make good lumber were pronounced in various parts of the South. And even in the Western States, where today 96 per cent of the nation's remaining virgin timber is located, industry is being forced to reach further into the more remote stands in the search for new *logging chances*.

At the present time, "we are overdrawing our saw timber bank account by about 18.6 billion board feet a year," the amount of saw timber being grown annually adding up to 35.3 billion board feet and the amount being cut or destroyed each year being 53.9 billion.

To overcome these conditions timber supplies needed for the future will have to be grown. An attempt to do this is seen in the industry-sponsored, tree-farm movement which was begun in the Pacific Northwest and has since spread to many states in the East and the South, the similarly sponsored trees-for-tomorrow planting campaign in the lake states, and the fact that the American Forest Products Industries — an organization representing major forest-industry groups — has adopted a program calling for continuous growing of trees on all land suited to the purpose and for bringing the widest area possible under permanent forest management.

Industrial forest owners are making encouraging advances in good cutting practice, but this alone will not solve the problem of future national timber supply, since corporate and other large holdings constitute only 15 per cent of the total commercial forest acreage and since for all private forest land 64 per cent of the cutting practice is currently classed as poor and destructive and only 7 per cent as good.

FURNITURE PATCHING

HAROLD L. ROUND
Patterson Park High School
Baltimore, Md.

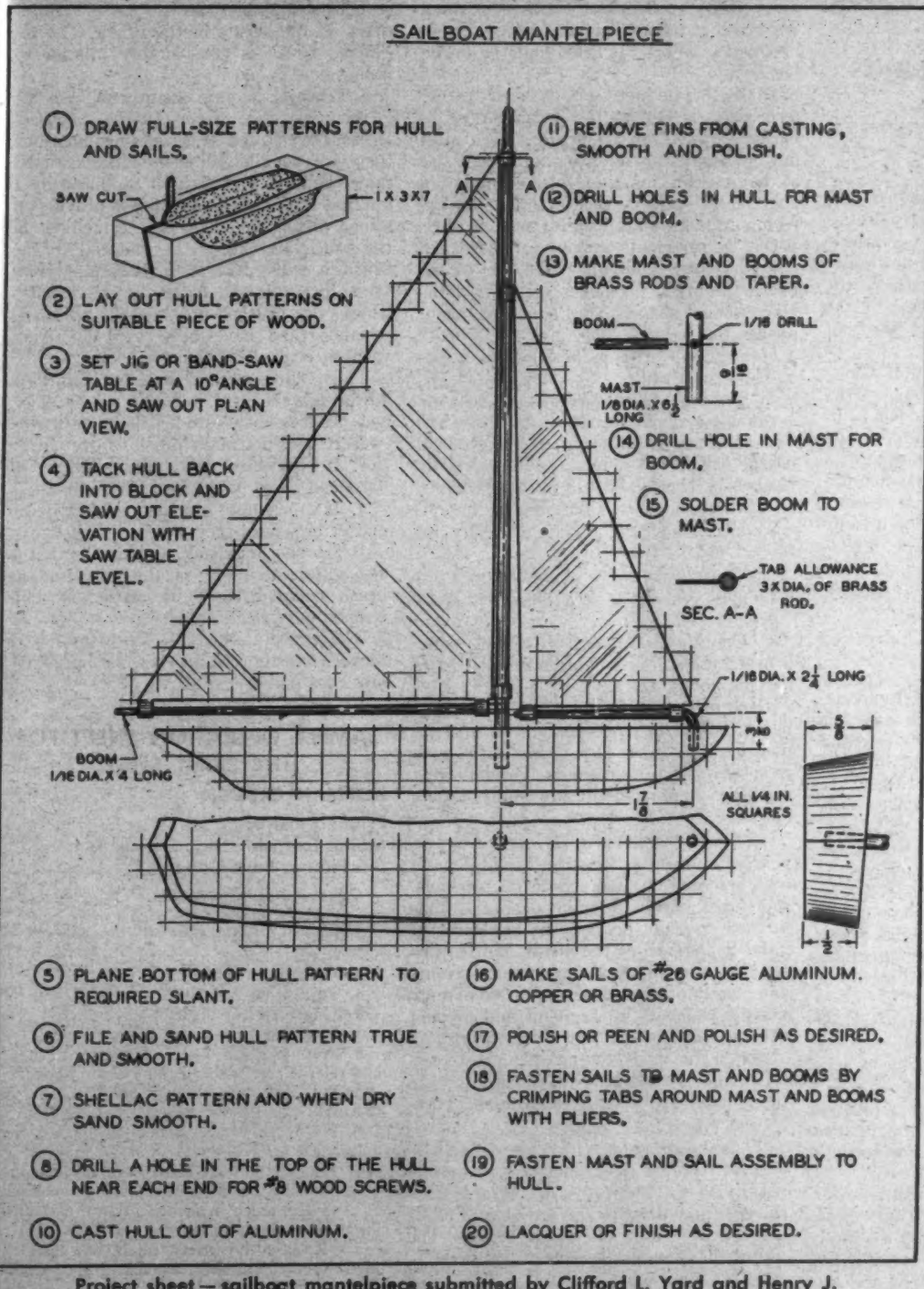
The retouching of worn-through or rubbed parts of furniture is an interesting and valuable technique which can be carried out with a small outlay for materials in any wood or craft shop. The technique will be valuable to future cabinetmakers and refinishers. It will appeal to the domestic interests of boys and girls, and make it possible for them to render a real service about the home. The mixing of colors will develop that artistic sense which distinguishes the craftsman from the ordinary mechanic.

A minimum list of materials for such work would be the following:

1. Small touch-up brushes of good quality.
2. Small containers, preferably of glass for mixing colors.
3. Denatured alcohol.
4. Finishing paper, 6/0 or 7/0.
5. Muslin.
6. Water stains.
7. Patching lacquer.
8. Dry colors.

The first step in retouching a rubbed-through or worn part is to sand the part smooth and to wipe it absolutely clean. It is then ready for staining. A water stain of the desired color is applied first, either with a sponge or cloth. The stain should be deep and applied liberally. The patch is allowed to dry and then sanded smooth with finishing paper, care being taken to sand as little as possible to avoid excessive removal of the stain. On the cheaper grades of furniture and on pieces stained very lightly further staining will be unnecessary; on better grades of furniture and in particular on dark-stained pieces such as mahogany and walnut the water stain will not be sufficient to bring the patch up to the color of the surrounding area. This can be accomplished by mixing the desired shade of dry color into a small quantity of patching lacquer and brushing the resultant stain on the patch, care being taken to brush as little as possible and in one direction only. The edges of the patch should then be "feathered" with the finger so that the patch blends with the surrounding area. Various shades of mahogany can be secured by mixing burnt sienna and lampblack, walnut can be matched with burnt umber, or burnt umber and yellow ocher for a lighter shade. Lampblack added to yellow ocher will produce oak, vermillion added to yellow ocher or raw sienna will give a shade of maple. From a combination of burnt sienna, raw sienna, burnt umber, vermillion, yellow ocher and lampblack most furniture colors can be matched, and except for vermillion the cost of these dry colors is very small.

After the patch has been allowed to dry for about one half hour, the job is completed by padding the patch with patching lacquer, a process known as French polishing. To do this a piece of muslin or other lintless material about 12 by 12 in. is cut and folded over twice. A small quantity of lacquer is then applied to a ball of cotton wadding about the size of an egg and the saturated wadding is placed on the folded muslin, the ends of which are drawn over the wadding to make a *rubber*. The rubber is pressed


SAILBOAT MANTELPIECE
(1) DRAW FULL-SIZE PATTERNS FOR HULL AND SAILS.
SAW CUT
1 X 3X7
(2) LAY OUT HULL PATTERNS ON SUITABLE PIECE OF WOOD.
(3) SET JIG OR BAND-SAW TABLE AT A 10° ANGLE AND SAW OUT PLAN VIEW.
(4) TACK HULL BACK INTO BLOCK AND SAW OUT ELEVATION WITH SAW TABLE LEVEL.
(5) PLANE BOTTOM OF HULL PATTERN TO REQUIRED SLANT.
(6) FILE AND SAND HULL PATTERN TRUE AND SMOOTH.
(7) SHELLAC PATTERN AND WHEN DRY SAND SMOOTH.
(8) DRILL A HOLE IN THE TOP OF THE HULL NEAR EACH END FOR #8 WOOD SCREWS.
(10) CAST HULL OUT OF ALUMINUM.
(11) REMOVE FINS FROM CASTING, SMOOTH AND POLISH.
(12) DRILL HOLES IN HULL FOR MAST AND BOOM.
(13) MAKE MAST AND BOOMS OF BRASS RODS AND TAPER.
BOOM
1/16 DRILL
MAST 1/8 DIA. X 6 1/2 LONG
(14) DRILL HOLE IN MAST FOR BOOM.
(15) SOLDER BOOM TO MAST.
TAB ALLOWANCE 3 X DIA. OF BRASS ROD.
SEC. A-A
1/16 DIA. X 2 1/4 LONG
BOOM 1/16 DIA. X 4 LONG
1 7/8
ALL 1/4 IN. SQUARES
5/8
1/2
(16) MAKE SAILS OF #26 GAUGE ALUMINUM. COPPER OR BRASS.
(17) POLISH OR PEEN AND POLISH AS DESIRED.
(18) FASTEN SAILS TO MAST AND BOOMS BY CRIMPING TABS AROUND MAST AND BOOMS WITH PLIERS.
(19) FASTEN MAST AND SAIL ASSEMBLY TO HULL.
(20) LACQUER OR FINISH AS DESIRED.

Project sheet — sailboat mantelpiece submitted by Clifford L. Yard and Henry J. Kauffman, industrial-arts department, State Teachers College, Millersville, Pa.

against the palm of the hand to start the flow of lacquer from the wadding through the muslin. The patch is then polished. The polishing is accomplished with a light rapid sweeping stroke, care being taken that the rubber never rests on the work. The strokes should be taken with the grain and carried beyond the edges of the patch. This amalgamates the patch with the surrounding surface and gives the stain a uniform and even appearance. The patch should be allowed to dry for several hours and then rubbed down with oil and pumice.

THE CARE OF PAINTBRUSHES

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The paintbrush problem is an old one. Many cleaning methods used today are injurious to the brush. Any brush cleaning method, to be satisfactory, must not injure bristle or setting, and it must prevent the hardening of material in the heel of the brush. Very few brushes are ever worn out from actual use.

Good paintbrushes are made of China pig bristle. The natural bristle has a taper and has small spikes or hair which helps hold the paint. The bristles are usually held together in the brush by means of a plastic cement which is insoluble in ordinary paint solvents. Not being a thermosetting cement it is subject to the dissolving action of some solvents. The ferrule should consist of heavy tin-plated steel and the handle should be made of well-seasoned straight grained wood.

Paintbrushes deteriorate in a number of ways:

1. The use of caustic materials in cleaning a brush results in the most rapid deterioration of the bristle. Caustic materials remove from the bristle certain essential oils which give the bristles the life and spring characteristic of a good brush. Some caustic materials are often contained in the brush cleaners sold on the market. Certain solvents (referred to later) have the same effect as the caustic since they leach out the oil which is contained in the bristle. Strong caustic such as soda lye will destroy the bristle completely. Bristles which have been affected by a caustic cleaner take on a drab appearance and lack the life and spring of new bristle.

Kerosene and related crude oil distillated are not paint solvents and as such their use in brush keepers does not provide a genuine brush cleaning action.

Some synthetic bristles used in brushes become matted together and the bristles curl up at the ends after having been in kerosene or mineral spirits.

2. Lacquer thinner and varnish remover are sometimes used to soften and clean brushes. When washed in thinner too often or immersed too deeply the setting of the brush will eventually be dissolved and the bristles will fall out of the brush.

3. When brushes are washed out and then left in the open air the setting of the brush dries out. This causes a shrinking of the plastic material in the cement, which then pulls away from the bristle resulting in loose bristles in the brush. The handle of the brush will also dry out and to some extent the bristle. This, however, is not as serious as the drying out of the setting.

4. Brushes which have been kept in water often break off at the ferrule when the brush is being cleaned. This is due to the rusting which has been going on inside the ferrule.

5. One of the more serious causes of deterioration is due to the accumulation of hardened paint in the bristle. Since most finishing materials used in shops today are of the quick-drying kind, this accumulation goes on in spite of the fact that we are trying to take good care of our brushes. When a sufficient amount of hardened paint has been built up in the heel of the brush the brush no longer keeps its desirable wedge shape. The hardened paint pushes the bristles apart giving the brush a *broom effect*. This makes the brush useless in a short while.

6. Soaking hardened brushes in creosote or shingle stain softens some hard brushes. The hardened paint seems to lose its hold on the bristle but it remains choked up in the brush. Then the brush must be combed so as to remove it. Considerable time is consumed in getting the brush ready for further use.

Since creosote is not a paint solvent it does only part of the job that needs to be done.

7. Continuous cleaning or washing of the brush causes a rapid deterioration. Bristles become flabby and soft.

Each method of brush care has its drawbacks. Some are purely makeshift and are used because of the lack of materials, such as solvents of various kinds. The following methods are commonly used in keeping brushes.

1. *Soaking brushes in linseed oil or turpentine.* Sometimes brushes are also hung into kerosene or other crude oil products, sometimes known as mineral spirits. This method does not prevent the hardening of paint in the heel of the brush. Neither linseed oil nor turpentine are paint solvents and merely prevent the evaporation of more volatile elements in the paint and prevent the exposure of the brush to the drying action of the air. Kerosene often causes certain enamels and varnishes to curdle in the brush making it unfit for a clean and satisfactory job.

2. *Soaking brush in lacquer thinner or varnish remover.* Both materials evaporate rapidly; both constitute a fire hazard. Both solvents may dissolve the setting and cause the bristle to drop out of the ferrule. The use of these materials requires caution.

3. *Washing brushes with soap and water.* This does not remove all of the hardened paint. Bristles lose some of their oils. Causes rusting of ferrule.

4. *Soaking brushes in some caustic solution such as tri-sodium phosphate to soften the brush or to wash out the paint.* Removes oil contained in the bristle, leaves bristle lifeless and flabby with repeated use.

5. *Soaking hard brushes in hot vinegar to soften them.* The acetic acid in the vinegar is a strong solvent. Brushes must not be boiled. This method also has a harmful effect on the bristle of the brush. The reclaimed brush is considerably inferior to the original.

6. Perhaps the most scientifically correct method is the *vapor action method.* Brushes are stored in a container in which they are completely enclosed. This container is filled with a vapor produced by a mixture of solvents. The vapor provides a strong dissolving action on the material in the brush and keeps the material in the brush in a dissolved state. The closed container prevents the escape of the vapors; hence, the brushes are kept in readiness whether they have been used in paint, varnish, enamel, lacquer, or shellac.

This vapor method has the following advantages:

1. It does not injure bristle or setting.
2. It does not allow brush to dry out.
3. It prevents the accumulation of hardened paint in the heel of the brush.
4. It reclaims brushes perfectly no matter how hard they were.

It has one drawback, and that is that it also softens the paint on the handle of the brush so that it has to be scraped off. This is done very easily, however.

The vapor method is easy to use. It is inexpensive and the brushes last until they are worn out.

SAMPLE OPERATION SHEET FOR THE PRINT SHOP

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Directions to Follow When Changing Linotype Ejector Blade on Model 5:

1. Push the clutch into safety position.
2. Open the vise.
3. Back the machine up.
4. Turn mold disk until open slot of mold wheel faces ejector blade.
5. Push out the ejector blade.
6. Seat yourself in the operator's chair, and release the catch on the ejector blade.
7. Pull the blade through the open slot in the mold wheel.
8. Place the ejector blade on top of the magazine.
9. Replace the new blade back through the open hole in the disk. This blade is inserted at a 45-deg. angle, with holes down, and then lower into level position.
10. Release the safety catch and test the blade in the following manner: Did it click? Try and pull the blade out by hand.
11. Pull the ejector blade all the way back.

12. Turn the mold disk so that the right mold lines up with the ejector blade.
13. Push the ejector blade handle forward to see if the blade clears the mold.
14. Turn on the machine.
15. Slowly release the clutch until the machine is in normal position, push the clutch back into safety position.
16. Change the vise measurements to correct size, push in the first elevator-jaw line stop, and close vise to secure position.
17. Change the delivery slide finger to the right measurement.
18. Reset assembler stick to right measurement.
19. Secure instructor's O.K.
20. Assemble a line in the stick and send it in.
21. Keep the hand on the clutch until the line is entirely cast, and out in the galley.
22. CAUTION: If anything sounds out of tune, or something happens, push in the clutch, and call the instructor.

MULTIPLE-RESPONSE TEST FOR STUDENTS OF DRAFTING

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Milwaukee, Wis.

Directions: Each of the following statements can be answered correctly by one and only one of the statements given below. Underline the letter before the statement which you think stands for the correct one. Do not guess.

Example: Studs are used to fasten cylinder heads because: (*a*) Cylinder heads are removed frequently; (*b*) Cylinder heads are made of cast iron; (*c*) It prevents the gasket from being damaged.

1. Mechanical drawing is used to describe clearly and accurately: (*a*) The shape and size of an object; (*b*) The scene drawn by an artist; (*c*) The skills and knowledge of a draftsman.
2. Mechanical drawing must be understood by: (*a*) Technical men; (*b*) Railroad engineers; (*c*) Stationary engineers.
3. The drawing board is made of: (*a*) masonite; (*b*) oak; (*c*) softwood.
4. A drawing board is cleated to: (*a*) raise it above the surface of the drawing table; (*b*) prevent it from warping; (*c*) prevent the incorrect use of the T square.
5. The working edge of the drawing board is along the: (*a*) top edge of the board; (*b*) bottom edge of the board; (*c*) left-hand edge of the board.
6. The T square is made of: (*a*) softwood; (*b*) hardwood; (*c*) steel.
7. The T square usually consists of (*a*) two parts; (*b*) one part; (*c*) three parts.
8. The T square used for ordinary drawing work consists of: (*a*) a fixed head with a thin tapered blade having a beveled working edge; (*b*) a fixed head with a thin blade having a perfectly straight working edge; (*c*) an adjustible head with a thin tapered blade.
9. The T square is used to draw: (*a*) vertical lines; (*b*) inclined lines; (*c*) horizontal lines.
10. A good draftsman owns at least: (*a*) one T square with a fixed head; (*b*) one T square with a movable head. (*c*) several T squares with fixed heads and having blades of varying lengths.
11. A right-handed person always places the T square on the board with the head riding along the: (*a*) top of the drawing board; (*b*) left edge of the drawing board. (*c*) right edge of the drawing board.
12. The triangles used in drafting are made of: (*a*) masonite; (*b*) celluloid; (*c*) softwood.
13. For ordinary drafting work a: (*a*) 6-in., 45-degree triangle is commonly used; (*b*) 8-in., 45-degree triangle is commonly used; (*c*) 10-in., 45-degree triangle is commonly used.
14. For ordinary drafting work a: (*a*) 8-in., 30–60 degree triangle is commonly used; (*b*) 10-in., 30–60 degree triangle is commonly used; (*c*) 12-in., 30–60 degree triangle is commonly used.
15. Triangles derive their name from their shape: (*a*) three angles; (*b*) three equal angles; (*c*) three equal sides.
16. The sum of the angles of a 45-degree triangle is: (*a*) 90 degrees; (*b*) 135 degrees; (*c*) 180 degrees.
17. The sum of the angles of a 30–60 degree triangle is: (*a*) 180 degrees; (*b*) 135 degrees; (*c*) 90 degrees.
18. The left vertical edge of either triangle is used to draw: (*a*) slant lines; (*b*) horizontal lines; (*c*) vertical lines.
19. The 45-degree triangle is used to draw: (*a*) a pentagon; (*b*) an octagon; (*c*) a hexagon.
20. The 30–60 degree triangle is used to draw: (*a*) a pentagon; (*b*) an octagon; (*c*) a hexagon.
21. A 45-degree triangle is used to divide a circle into: (*a*) 12 equal parts; (*b*) 10 equal parts; (*c*) 8 equal parts.
22. A 30–60 degree triangle is used to divide a circle into: (*a*) 12 equal parts; (*b*) 10 equal parts; (*c*) 8 equal parts.
23. The 45-degree triangle is: (*a*) an equilateral triangle; (*b*) an isosceles triangle; (*c*) a scalene triangle.
24. The 30–60 degree triangle is: (*a*) an equilateral triangle; (*b*) an isosceles triangle; (*c*) a right-angled triangle.
25. By combining the 30–60 degree triangle with the 45-degree triangle, it is possible to draw an angle of: (*a*) 10 degrees; (*b*) 15 degrees; (*c*) 45 degrees.
26. An acute angle is an angle having: (*a*) less than 90 degrees; (*b*) just 90 degrees; (*c*) more than 90 degrees.
27. An obtuse angle is an angle having: (*a*) less than 90 degrees; (*b*) just 90 degrees; (*c*) more than 90 degrees.
28. An equilateral triangle is a triangle having: (*a*) three equal angles; (*b*) two equal angles; (*c*) no equal angles.
29. An isosceles triangle is a triangle having: (*a*) three equal angles; (*b*) two equal angles; (*c*) no equal angles.
30. A protractor is used for: (*a*) measuring or setting off angles other than those obtainable with the regular triangles; (*b*) measuring and drawing circles; (*c*) locating the centers of circles.
31. An erasing shield is used: (*a*) when erasing just pencil lines; (*b*) when erasing just ink lines; (*c*) to protect lines adjacent to the area to be erased.
32. The drawing paper is fastened to the board by using: (*a*) carpet tacks; (*b*) gimp tacks; (*c*) thumb tacks.
33. Some draftsmen prefer to fasten the drawing paper to the board by the use of: (*a*) adhesive tape; (*b*) scotch drafting tape; (*c*) mending tape.
34. The drawing pencil chosen by a draftsman should be: (*a*) hard enough to groove the paper; (*b*) soft enough to blur or smudge the drawing; (*c*) hard enough not to groove the paper and soft enough not to blur or smudge the drawing.
35. The proper drawing pencil to use for freehand technical sketches is a: (*a*) 2B pencil; (*b*) HB pencil; (*c*) 2H pencil.
36. The proper drawing pencil to use for mechanical drawing is a: (*a*) 2H pencil; (*b*) 4H pencil; (*c*) 6H pencil.
37. The identification numeral and letter 4H on a drawing pencil indicates whether the lead in the pencil is: (*a*) soft; (*b*) medium; (*c*) hard.
38. Drawing pencils are hexagonal in shape: (*a*) because it gives the pencil a better appearance; (*b*) to prevent the pencil from rolling off the table; (*c*) as it is easier to make pencils hexagonal than to make pencils round.
39. Always sharpen the unlettered end of a drawing pencil because: (*a*) that end is easier to sharpen; (*b*) the grade mark of the pencil is preserved which makes it easier to identify the pencil; (*c*) the lead in the pencil is of a better quality at that end.
40. The long conical point is preferred by draftsmen: (*a*) to lay off measurements accurately on the drawing; (*b*) because it can be made more easily than any other; (*c*) as this point wears longer under continual use than any other.
41. The long chisel point is preferred by some draftsmen: (*a*) as an ideal point for all straight line work; (*b*) as an ideal point for all lettering; (*c*) as an ideal point for freehand sketching.
42. A good draftsman always keeps his pencils well sharpened because: (*a*) he can make straighter lines with a well sharpened point; (*b*) a well sharpened point looks better; (*c*) he can do better and more accurate drawing.
43. A good draftsman: (*a*) never brushes or dusts off excess graphite from his pencil drawing; (*b*) always corrects a poor pencil drawing during the process of inking; (*c*) occasionally dusts off excess graphite from the pencil drawing to prevent smudging.
44. A horizontal line is one that is: (*a*) parallel to the horizon; (*b*) perpendicular to the horizon; (*c*) at an angle to the horizon.
45. Horizontal lines are ruled: (*a*) from left to right along the lower edge of the T square; (*b*) from left to right along the upper edge of the T square; (*c*) from right to left along the upper edge of the T square.
46. Location points for horizontal lines are usually marked off along the: (*a*) upper edge of the drawing paper; (*b*) lower edge of the drawing paper; (*c*) left edge of the drawing paper.
47. A vertical line is one that is: (*a*) parallel to the horizon; (*b*) perpendicular to the horizon; (*c*) at an angle to the horizon.
48. Vertical lines are drawn along the vertical edge of either triangle set against the: (*a*) upper edge of the T-square blade; (*b*) lower edge of the T-square blade; (*c*) inner edge of the T-square head.
49. Vertical lines are drawn from: (*a*) left to right along the left edge of either triangle; (*b*) upward along the left edge of either triangle; (*c*) downward along the slant edge of either triangle.
50. The location points for vertical lines are marked off along the: (*a*) left edge of the

drawing paper; (*b*) right edge of the drawing paper; (*c*) upper edge of the drawing paper.

51. The irregular curve is used: (*a*) for drawing curved lines; (*b*) to draw circles; (*c*) to draw arcs.

52. The scale commonly used as a measuring device in mechanical drawing is the: (*a*) civil engineers scale; (*b*) architects scale; (*c*) metric scale.

53. The architects scale is divided into: (*a*) decimals; (*b*) fractions; (*c*) centimeters.

54. As a general rule, machine parts are seldom drawn at a scale less than: (*a*) 1½ in. equal to 1 ft., 0 in.; (*b*) 3 in. equal to 1 ft., 0 in.; (*c*) 6 in. equal to 1 ft., 0 in.

55. When an object is too large to fit the drawing paper, it is drawn at: (*a*) a reduced scale; (*b*) double scale; (*c*) half scale.

56. When an object is very small and difficult to dimension and draw to full scale, it is drawn at: (*a*) half scale; (*b*) double scale; (*c*) an enlarged scale.

57. A line 5½ in. long drawn at a scale of 6 in. equals 1 ft., 0 in. will be: (*a*) 9 in. long when drawn at a scale of 12 in. equals 1 ft., 0 in.; (*b*) 11 in. long when drawn at a scale of 12 in. equals 1 ft., 0 in.; (*c*) 13 in. long when drawn at a scale of 12 in. equals 1 ft., 0 in.

58. A line that is 3½ in. long is equivalent to: (*a*) 52 sixteenths; (*b*) 56 sixteenths; (*c*) 60 sixteenths.

59. The decimal equivalent of the fraction 1/16 equals: (*a*) .0625; (*b*) .125; (*c*) .03125.

60. The dimensions given on a drawing made to a scale of 6 in. equals 1 ft., 0 in. are: (*a*) the same as the size of the object; (*b*) one half the size of the object; (*c*) double the size of the object.

61. Accurate drawing depends greatly upon the correct use of the scale, hence: (*a*) all measurements are taken directly off the scale with the dividers; (*b*) all measurements are taken directly off the scale with the compass; (*c*) the scale is placed on the drawing with the edge of the scale parallel to the line on which the measurement is required and then the distance is pointed off.

62. The most important part of a drawing as far as appearance is concerned is the: (*a*) lettering; (*b*) line work; (*c*) accuracy.

63. The lettering used on mechanical drawing is the: (*a*) Old Roman lettering; (*b*) Freehand Gothic lettering; (*c*) Old English lettering.

64. Letters of the alphabet which are capitals are known as: (*a*) large letters; (*b*) big letters; (*c*) upper-case letters.

65. Letters of the alphabet which are not capitals are known as: (*a*) small letters; (*b*) lower-case letters; (*c*) little letters.

66. The ability to letter well can be acquired through: (*a*) continued and diligent practice; (*b*) copying from lettering cards; (*c*) no practice whatsoever.

67. A necessary aid to good lettering is: (*a*) guide lines drawn very lightly in pencil; (*b*) guide lines drawn very heavily in pencil; (*c*) to omit all guide lines.

68. All letters and numerals are made: (*a*) with the use of lettering guides; (*b*) freehand; (*c*) with the use of drawing instruments.

69. Lettering with a pencil is done with a: (a) H or 2B pencil having a conical point; (*b*) 4B or 5B pencil having a conical point; (*c*) 4H or 5H pencil having a conical point.

70. Ordinary size letters are inked with a: (*a*) ruling pen; (*b*) Hunt No. 512 pen or an Esterbrook pen No. 968; (c) Gillott No. 303 or No. 404 pen.

71. Arrowheads are made: (*a*) with a triangle; (*b*) freehand; (*c*) with a scale.

72. The bar dividing the fraction is made: (*a*) parallel with the dimension; (*b*) at an angle with the dimension; (*c*) at right angles with the dimension.

73. The total height of the fraction is: (*a*) 1 1/3 the height of the whole number; (*b*) 1 1/2 the height of the whole number; (*c*) 1 2/3 the height of the whole number.

74. All lines used on a mechanical drawing are: (*a*) of the same weight; (*b*) of different weight; (*c*) light full lines.

75. The purpose of a border line is to: (*a*) assist in centering the drawing on the drawing paper; (*b*) assist in placing dimensions in a straight line; (*c*) improve the appearance of the drawing.

76. The border line is usually a: (*a*) heavy dark line; (*b*) medium line; (*c*) light line.

77. The outline of the object or the visible edges of the object are represented by a: (*a*) heavy full line; (*b*) medium full line; (*c*) light full line.

78. The hidden or invisible edges of an object are represented by a: (*a*) light dotted line; (*b*) medium dotted line; (*c*) heavy dotted line.

79. The dotted line or invisible object line is a medium line composed of: (*a*) long and short dashes alternately spaced; (*b*) short dashes about ⅛ inch long with spaces 1/16 inch long; (*c*) long dashes with short spaces alternately spaced.

80. A straight line drawn from the center of a circle to the circumference of the circle is the: (*a*) radius; (*b*) diameter; (*c*) chord.

81. A straight line passing through the center of a circle with both ends intersecting the circumference is the: (*a*) radius; (*b*) segment; (*c*) diameter.

82. The dividers are used to: (*a*) draw circles of 1 in. or less in diameter; (*b*) transfer measurements and to divide a line into any number of equal parts; (*c*) draw circles of one inch or more in diameter.

83. The needle point of the compass is: (*a*) not to project beyond the lead point; (*b*) to project slightly beyond the lead point; (*c*) to be in line with or even with the lead point.

84. The compass is used to draw circles of: (*a*) 2 in. or more in diameter; (*b*) 2 in. or less in diameter; (*c*) any diameter.

85. The bow pencil is used to draw circles having a radius of: (*a*) 1 in. or more; (*b*) 1 in. or less; (*c*) any length.

86. The bow pen is used to draw ink circles having a diameter of: (*a*) any length; (*b*) 2 in. or less; (*c*) 2 in. or more.

87. The ruling pen is used to ink: (*a*) letters and dimensions; (*b*) straight lines; (*c*) curved lines as circles.

88. Curved lines which cannot be drawn with a compass are drawn with a: (*a*) French curve; (*b*) beam compass; (*c*) freehand.

89. Dimension lines are made: (*a*) medium in weight; (*b*) light full lines; (*c*) thick full lines.

90. In a circle there are: (*a*) 360 deg.; (*b*) 180 deg.; (*c*) 90 deg.

91. A circle has: (*a*) two center lines; (*b*) three center lines; (*c*) one center line.

92. A straight line that touches a circle in one point only is a: (*a*) diameter; (*b*) chord; (*c*) tangent.

93. Two circles drawn from the same center are: (*a*) concentric circles; (*b*) eccentric circles; (*c*) circles which are tangent to each other.

94. In mechanical drawing when the expression "3-in. circle" is used, it means that the circle: (*a*) is 3 in. in diameter; (*b*) has a circumference of 3 in.; (*c*) has a radius of 3 in.

95. The circumference of a circle is the: (*a*) perimeter of the circle; (*b*) distance around the circle; (*c*) distance across the circle.

96. A five-sided polygon is called a: (*a*) pentagon; (*b*) hexagon; (*c*) octagon.

97. A polygon having four equal sides and four equal angles is called a: (*a*) triangle; (*b*) rectangle; (*c*) square.

98. It is considered good practice to give dimensions on: (*a*) extension lines; (*b*) dimension lines; (*c*) center lines.

99. A hexagon has: (*a*) five equal sides; (*b*) six equal sides; (*c*) nine equal sides.

100. The center line used in mechanical drawing is shown as: (*a*) a long, fine, full line; (*b*) a dotted line; (*c*) a line having long and short dashes alternately spaced.

ANSWERS TO MULTIPLE-RESPONSE EXERCISE

1. *a*	18. *c*	35. *b*	52. *b*	69. *a*	86. *b*
2. *a*	19. *b*	36. *b*	53. *b*	70. *c*	87. *b*
3. *c*	20. *c*	37. *c*	54. *a*	71. *b*	88. *a*
4. *b*	21. *c*	38. *b*	55. *a*	72. *a*	89. *b*
5. *c*	22. *a*	39. *b*	56. *c*	73. *c*	90. *a*
6. *b*	23. *b*	40. *a*	57. *b*	74. *b*	91. *a*
7. *a*	24. *c*	41. *a*	58. *b*	75. *c*	92. *c*
8. *b*	25. *b*	42. *c*	59. *a*	76. *a*	93. *a*
9. *c*	26. *a*	43. *c*	60. *a*	77. *a*	94. *a*
10. *c*	27. *c*	44. *a*	61. *c*	78. *b*	95. *b*
11. *b*	28. *a*	45. *b*	62. *a*	79. *b*	96. *a*
12. *b*	29. *b*	46. *c*	63. *b*	80. *a*	97. *c*
13. *b*	30. *a*	47. *b*	64. *c*	81. *c*	98. *b*
14. *c*	31. *c*	48. *a*	65. *b*	82. *b*	99. *b*
15. *a*	32. *c*	49. *b*	66. *a*	83. *b*	100. *c*
16. *c*	33. *b*	50. *c*	67. *a*	84. *a*	
17. *a*	34. *c*	51. *a*	68. *b*	85. *b*	

GENERAL PRINTING PROJECT TEST

ISRAEL BENSMAN
Central High School
Sheboygan, Wis.

Most printing tests prepared by instructors are a compilation of questions based on units of instruction, such as composition, imposition, presswork, bindery, etc. The majority of the statements in the following test have been based on the things done and learned by the student as he works on each printed project. Items on learning units are incorporated into the test along with specific items on the project itself. The test items are organized under 17 projects. The test can be given as a diagnostic test upon the completion of each project, or it can be given as a course survey test upon the completion of all 17 projects.

Project No. 1. Business Card

1. What six details should a layout show?
   a) ..... *b*) .....
   c) ..... *d*) .....
   e) ..... *f*) .....
2. A business card which cuts 88 to a sheet is known as a .....
3. ..... cards are those cut by means of dies.
4. The five general classifications of type as suggested by Polk are:
   a) ..... *b*) .....
   c) ..... *d*) .....
   e) .....

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MAKERS OF MOVIE EQUIPMENT SINCE 1910

5. List the styles of type you used and state under which type classification each style of type is included.

Line No.	*Style Used*	*Classification*
1.	.....	.....
2.	.....	.....
3.	.....	.....
4.	.....	.....
5.	.....	.....
6.	.....	.....
7.	.....	.....

6. In the following list there are various procedures in advanced composition. They are not in proper sequence. In the spaces at the left put the correct numbers in proper sequence, as you would do the job.
   ( ) 1. take proof
   ( ) 2. place slug top and bottom
   ( ) 3. mark copy for measures, sizes, faces
   ( ) 4. space out, group related parts
   ( ) 5. set type lines
   ( ) 6. make several sketches
   ( ) 7. measure for margins with folded card
   ( ) 8. empty stick and place on galley
   ( ) 9. analyze copy
7. What is the largest type ordinarily used on cards? .....

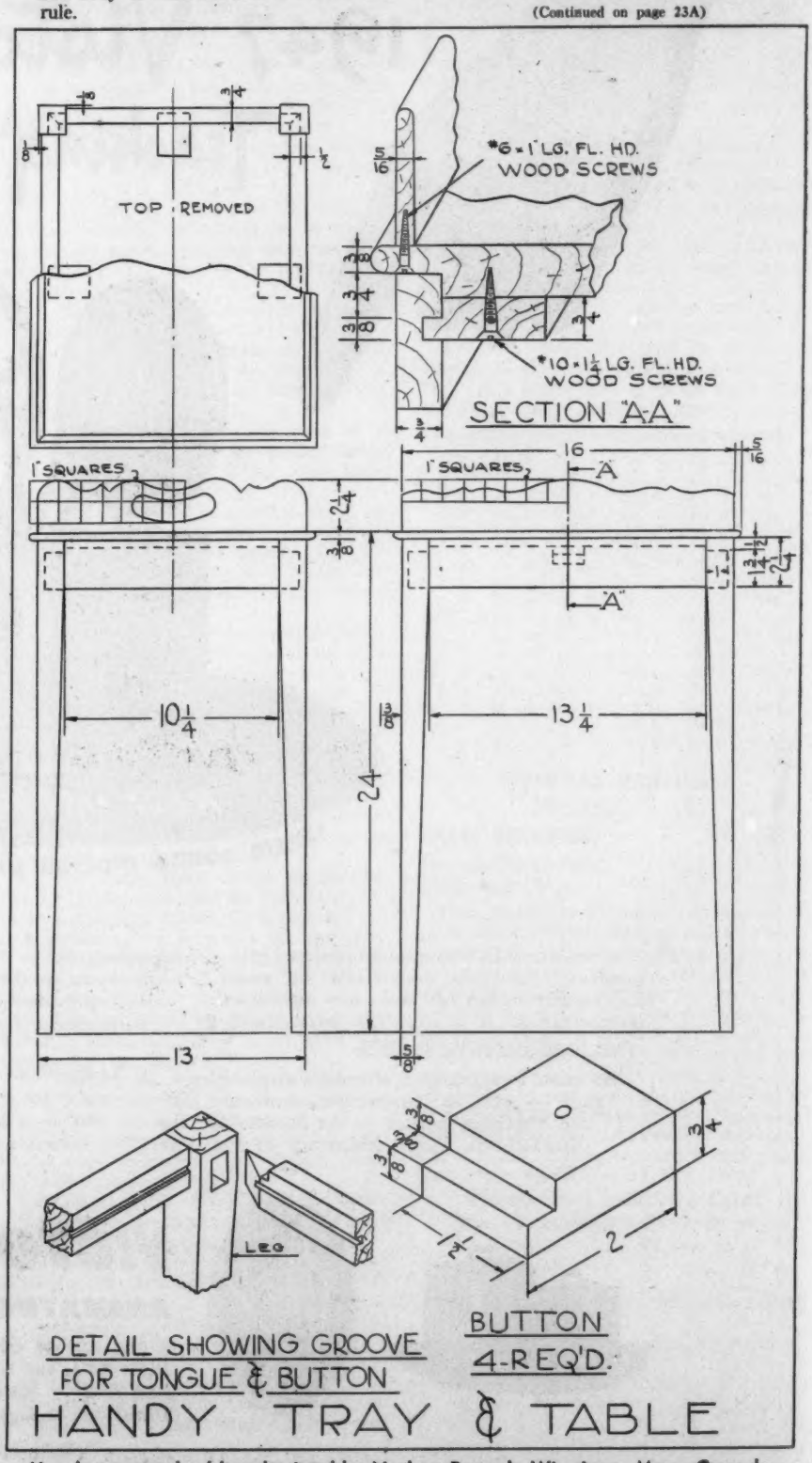
Project No. 2. Letterhead

1. How many sheets of paper make up a ream? .....
2. The standard full size letterhead is ..... by ..... inches.
3. What substance is bond paper coated with to prepare the surface for writing purposes? .....
4. The highest grades of bond paper are made of .....
5. What kind of ink is preferred for an ordinary letterhead? .....
6. What is the preferred basic weight of bond? .....
7. Name several methods other than letterpress by which letterheads can be reproduced.
   a) ..... *b*) .....
   c) ..... *d*) .....
8. What is the basic size of bond? .....
9. What is the preferred position of a watermark on a letterhead? .....
10. How many pieces 8½ by 11 in. can be cut from ..... reams of paper 17 by 22 in.? Show figuring.
11. What is the cost of ..... sheets of 17 by 22 bond, if priced at $4.50 a ream? Show figuring.
12. Are watermarks used on many of the best bonds? Why?
13. What is the cylindrical roll called that produces a watermark on bond paper in a papermaking machine? .....
14. What three items of copy are essential for an effective letterhead?
   a) .....
   b) .....
   c) .....

Project No. 3. Statement

1. The size, in inches, of the standard statement form is .....
2. The light rule used in the form is called .....
3. The heavier rule used in the form is called .....
4. What kind of stock is most frequently used for invoices, billheads, and statements? .....
5. In determining the order of display, the first points to consider are ....., ..., ..., in the order named.
6. The preferred division for separating head and body of statements is a ..... face rule.
7. The depth of the head of a statement from the top edge of the sheet to the cut-off rule should rarely exceed ..... picas.
8. What is meant by "bleed" rules? .....

(Continued on page 23A)



Handy tray and table submitted by Nathan Bogoch, Winnipeg, Man., Canada

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EAGLE PENCIL COMPANY OF CANADA, LTD., TORONTO

(Continued from page 20A)

Project No. 4. Label

1. Is there a standard size and shape of label? .....
2. What is a gummed label? .....
3. What is "packing"? .....
4. What word is used to describe an ink that is thick and sticky? .....
5. Where may the name and address of the sender be placed on a label? .....
6. How may the curl be removed from gummed sheets? .....

Project No. 5. Personal Card

1. There are two classes of visiting cards, the ..... and the .....
2. Men's social cards should carry the courtesy title "....."
3. A finish of paper, similar to the texture of linen, is referred to as a ..... finish.
4. A smooth, slightly glossy finish given to cardboard by calendering is a ..... finish.
5. A finish on paper in imitation of vellum; a hard, smooth, plated finish, but free from gloss, is a ..... finish.
6. What is *blind paneling?* .....
7. What size of type is used for name cards? .....
8. Should addresses appear on visiting cards? .....
9. Visiting cards were used as early as the 13th century by the .....
10. What factor determines the size of social cards? .....
11. Why are men's cards smaller than women's cards? .....
12. Should men's social titles be placed on business and professional cards? .....
13. Are colored inks in good taste for personal cards? .....
14. How can black ink be darkened for use on rough card stock for personal cards? .....

Project No. 6. Menu

1. Why should menus be printed on light stock and in large, legible type? .....
2. It is customary to ..... every noun and important word in a menu.
3. What is a French fold? .....
4. How is type for menus usually set? .....
5. When setting a menu, is it permissible to mix dishes from several courses? .....
6. What should be done to give a pleasing contour to a menu? .....
7. Give three rules for setting menus:
   a) .....
   b) .....
   c) .....

Project No. 7. Program

1. Roman numerals are made up of ..... letters and are usually lined up on the ..... side.
2. What are the four purposes for which programs are used?
   a) .....
   b) .....
   c) .....
   d) .....
3. When setting musical programs, what should be specially checked for correct spelling and listing? .....
4. Are hyphen leaders appropriate for program work? .....
5. Upon what kind of paper are simple programs usually printed? .....
6. How are dance programs usually tied?
7. Professional musical programs are usually printed in the form of a ..... page folder.

Project No. 8. Announcement

1. Should business announcements be more dignified in appearance than usual newspaper ads? .....
2. Are plain borders permissible on business announcements? .....
3. If an announcement is in the form of a four-page folder, it should be printed on the ..... page.
4. For what purposes are business announcements chiefly used?
   a) ..... b) ..... c) .....
5. What kind of paper stock should be used for printing business announcements? .....
6. What are the preferred colors?
   a) ..... b) ..... c) ..... d) .....
7. Extremely formal announcements are sometimes set in ..... (all caps or all lower case.) Which one?
8. Should decorative border designs be used on announcements?

Project No. 9. Ticket

1. What is the preferred weight of ticket bristol? .....
2. What is a ply? .....
3. How did Bristol board get its name? .....
4. Does the U. S. government keep a record of tickets printed for events where an admission is charged? If so, why? .....

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5. List several uses of tickets.
   a) ..... *b*) ..... *c*) .....
6. Type selected for a ticket should be clean-cut and ..... to read.
7. The most prominent line on a ticket would carry .....

Project No. 10. Envelope Corner

1. Two common sizes of envelopes are ..... and .....
2. What is the primary purpose of the envelope corner card? .....
3. On what type of press are most envelopes printed? .....
4. What is a press drawsheet? .....
5. What is meant by press make-ready? .....
6. Why are envelopes usually fed head down into the press? .....
7. How is the envelope held in position on the press while being printed? .....
8. Would an envelope marked Sub. 16 be lighter or heavier than one marked Sub. 20? .....
9. Envelopes should match the ..... in paper, ink, and typography.
10. Nearly all commercial and official envelopes are packed in boxes of ..... each.

Project No. 11. Check or Receipt Blank

1. Should the weight of rule match the weight of type used on a check or receipt form? .....
2. A check, to which is attached a receipt establishing the facts and records of a business transaction, is called a ..... check.
3. Are there standard sizes for checks? .....
4. Any good grade of bond paper may be used for a check, but many users prefer a special ..... paper.
5. A ..... perforation is always used on checks, not the familiar hyphen incision made by perforating rule.
6. Are Roman display faces appropriate for bank checks? .....

Project No. 12. Advertisement

1. Why is script type sparingly used in newspaper advertisements? .....
2. What one word describes the written or printed material that is to be composed? .....
3. Why is border often used on advertisements? .....
4. Half tones are reproductions of .....
5. Zinc etchings are reproductions of .....
6. A general layout for a folder or booklet, or a preliminary arrangement of an advertisement is called a .....
7. If the advertising rate of a newspaper is ..... per column inch, what is the cost of an ad that is 2 columns by 5 in.? .....
8. A compositor who sets advertisements on a publication is an .....
9. Generally, how wide are newspaper columns? ..... picas.

Project No. 13. Color Chart

1. The three primary colors are:
   a) ..... *b*) ..... *c*) .....
2. To mix secondary colors,
   a) ..... and ..... make green.
   b) ..... and ..... make violet.
   c) ..... and ..... make orange.
3. Why is it not advisable to use a transparent ink on a colored stock? .....
4. In mixing a tint, the ..... color is added to the ..... base.
5. The two main constituents of an ink are
   a) ..... *b*) .....
6. A shade is produced by the addition of .....

Project No. 14. Shipping Tag

1. Of what stock are shipping tags usually made? .....
2. How should tags be fed into the press? .....
3. What is the standard arrangement of type on a tag? .....
4. Shipping tags are made in ..... standard sizes.
5. When feeding tags, why should you place very few tags on the feedboard at one time? .....
6. ..... and ..... are two of the most common colors for tag stock.
7. The side margin on the tag, between the eyelet and type should be at least two picas or more, because .....

Project No. 15. Notebook Cover

1. The optical center is ..... the actual center of a page.
2. The process of creasing a piece of paper on the press is called .....
3. Ink dries by ..... on hard paper, and by ..... on soft paper.
4. Two characteristics of cover paper are:
   a) ..... *b*) .....
5. List several finishes of cover papers:
   a) ..... *b*) ..... *c*) .....
6. Three requirements for a good cover are:
   a) .....
   b) .....
   c) .....

(Continued on page 26A)

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ALCOA ALUMINUM AND ITS ALLOYS
1946; 153 pages; 18 illustrations

Fundamental information concerning the many Alcoa Aluminum Alloys. Data in tabular form on their chemical and physical properties as well as the tolerances and sizes of all commercial forms.

RIVETING ALCOA ALUMINUM
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Detailed information on riveting aluminum and its alloys. Covers strength and proportions of riveted joints, driving methods, and selection of rivet alloy. Also, brief account of aircraft riveting.

MACHINING CHART
14 x 20 inches

Describes proper rake angles for machining aluminum, correct tool material, best cutting speeds and feeds, and types of cutting compounds. Illustrations show types and uses of numerous tools used in machining aluminum.

FINISHES FOR ALUMINUM
1946; 59 pages; 55 illustrations

A handbook which discusses the many kinds of finishes that can be applied to aluminum by mechanical, organic, chemical, electrochemical, and electroplating methods.

WELDING AND BRAZING ALCOA ALUMINUM
1945; 100 pages; 43 illustrations

Complete information on torch, arc, resistance welding, and brazing of aluminum. Six full-color illustrations of welding flame adjustments.

CASTING ALCOA ALLOYS
1947; 94 pages; 22 illustrations

General foundry principles, including melting, molding, and finishing. A complete description of the various aluminum casting alloys is listed in convenient form.

WELDING AND BRAZING CHART
10¾ x 13¾ inches

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Which of these books and visual aids do you need? They will prove invaluable to any teacher whose students are working with aluminum; *especially* necessary for those whose students are competing in the Aluminum Project Division of Scholastic Industrial Arts Awards, sponsored by Scholastic Magazine and Aluminum Company of America. Below is additional material, useful for general background information on aluminum. All teaching aids described on this page sent free to industrial arts teachers. Write ALUMINUM COMPANY OF AMERICA, 1773 Gulf Building, Pittsburgh 19, Pa.

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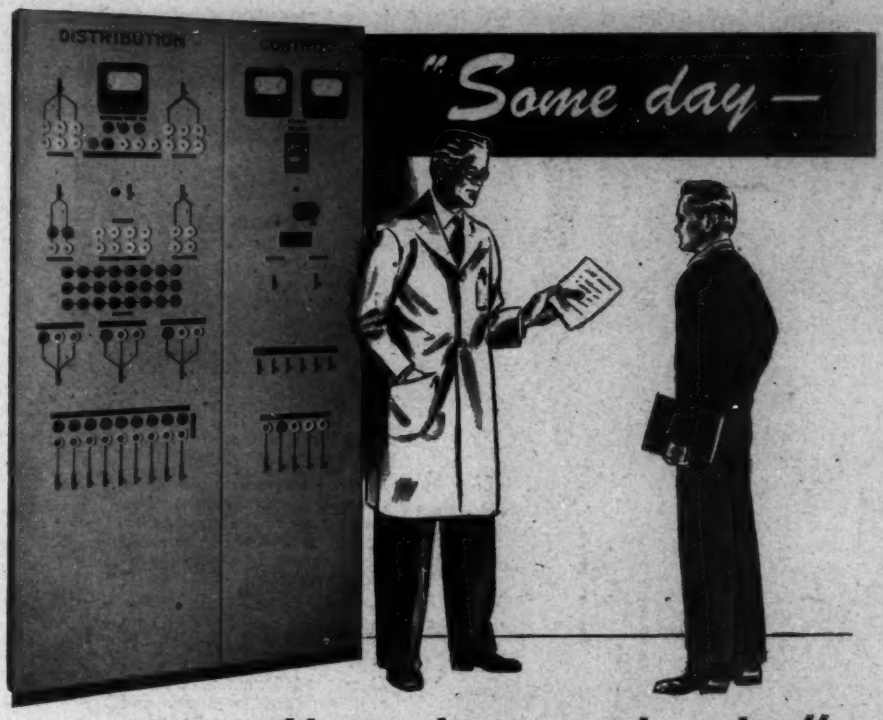
ALCOA FIRST IN ALUMINUM



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SPRINGFIELD 2 STANDARD FOUNDED 1884 MASSACHUSETTS

(Continued from page 24A)

7. The most convenient method of attaching a cover to a booklet is .....
8. The shape of the product will often suggest the ..... of the booklet.

Project No. 16. Weekly Calendar

1. An advertising message printed on heavy cardboard and intended especially for display in store windows is called a ....
2. Steel ..... rule is used to cut slits or various designs out of paper stock.
3. ..... paneling is the process of making a raised or sunken design in paper stock without the use of ink.
4. Sans serif means type ..... serifs.
5. .....ink is used for printing on bristols.
6. The process of arranging type matter on the galley into correct form for printing is called .....

Project No. 17. Booklet Cover, Title Page, and Pages

1. Most title pages consist of ..... or ..... groups of type.
2. The ..... is the most important group of the title page and is given the most emphasis.
3. A ..... rule is used to separate the parts of a title page.
4. When type is set too wide for the page, it is said to lack ..... harmony.
5. A ..... is a sample booklet made up to show proposed size, shape, stock of the finished work.
6. A descriptive line under an illustration is called a .....
7. A short line at the top of a page is called a .....
8. ..... matter is type set and ready for use.
9. ..... matter is type that has been set without leads between the lines.
10. ..... means putting impression beneath the tympan paper.
11. A ..... is a page number.

KEY

Project No. 1. Business Card

1. *a*) show width and depth in picas
   b) indicate size of stock and margins
   c) show measure, point, size, name of types
   d) indicate point size and style of border (if one is to be used)
   e) show size (in picas) and position of illustrations
   f) suggest, by spacing and tone of lines, the approximate size and weight of type groups
2. No. 88
3. Die-cut
4. *a*) Roman *b*) Italic *c*) Text *d*) Gothic *e*) Script
5. Answers will vary depending upon the styles used
6. Sequence: 9, 6, 3, 5, 8, 4, 7, 2, 1
7. Type larger than 14 pt. is seldom used on business cards. An 18 pt. line can occasionally be used if in lower case

Project No. 2. Letterhead

1. 500
2. 8½ by 11 in.
3. sizing
4. rags
5. good quality of stiff bond ink
6. 20-pound basic weight
7. copperplate engraving, lithography, offset, thermography
8. 17 by 22 in.
9. Watermark is centered right side up on each letterhead
10 & 11. (change numbers on each student's work to avoid copying)
12. Yes — as an assurance of quality; the company's trademark
13. "dandy roll"
14. *a*) Copy should be brief as possible
    b) Illustrations should be used only if they contribute to the appearance
    c) alternative answers:
       a) name of firm or individual
       b) line of business
       c) full address

Project No. 3. Statement

1. 5½ by 8½ inches
2. hairline (answers may vary in different shops)
3. one point or 1½ point (answers may vary in different shops)
4. 20-lb. white bond
5. Who? What? Where?
6. parallel
7. 15 picas
8. rules that print off the edges of stock

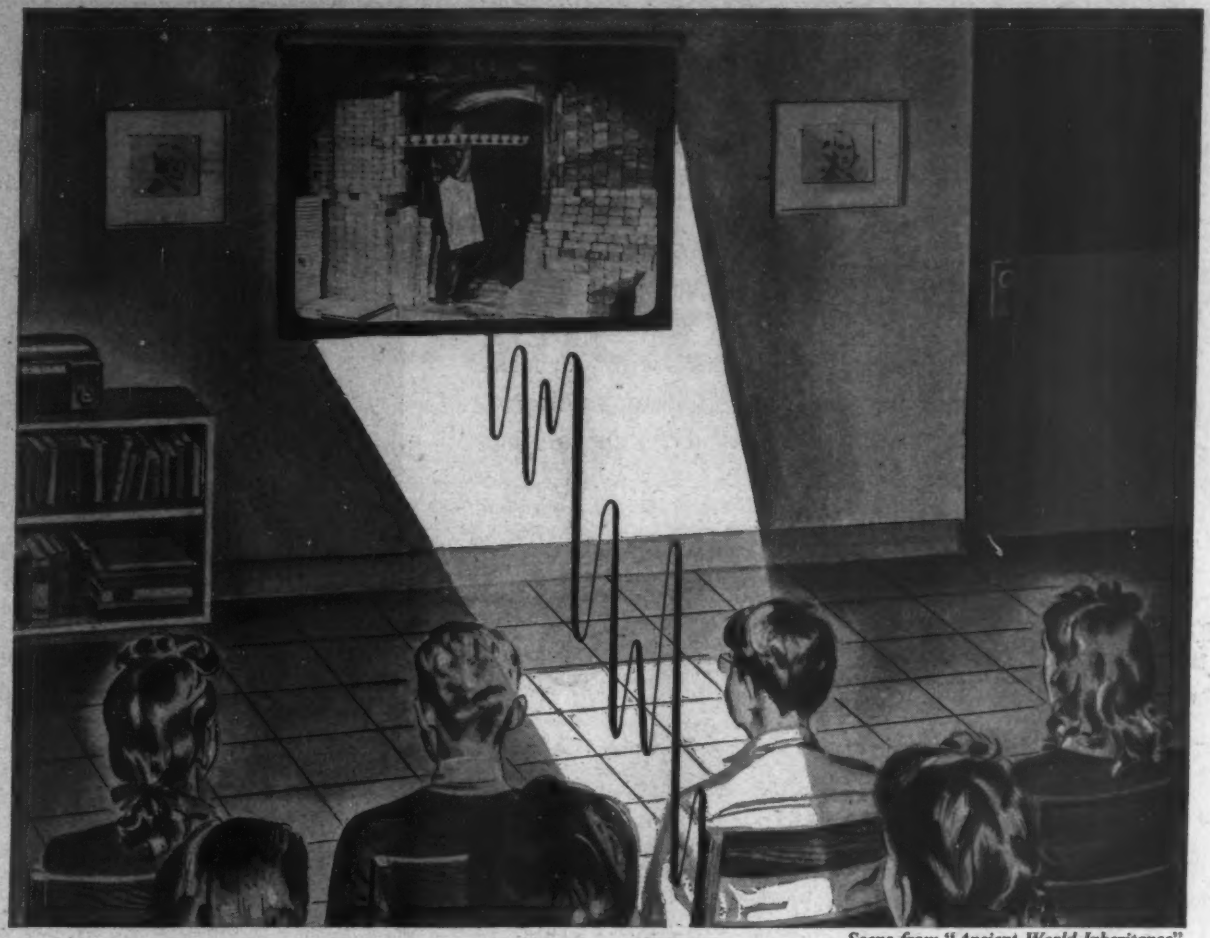
Project No. 4. Label

1. No
2. paper that is coated on one side with an adhesive and printed on the other side
3. that portion of the tympan below the drawsheet on the press
4. tacky
5. top, bottom, or to one side; no fixed style
6. roll the paper the opposite way to break the gummed side into countless pieces of little squares

Project No. 5. Personal Card

1. single, double
2. Mr.
3. linen
4. plate
5. vellum
6. without ink

(Continued on page 28A)



Scene from "Ancient World Inheritance" — Coronet Instructional Films, Inc.

SOUND FILMS play vital role in teaching the "One-World" concept

Sound films bring the world into the classroom.

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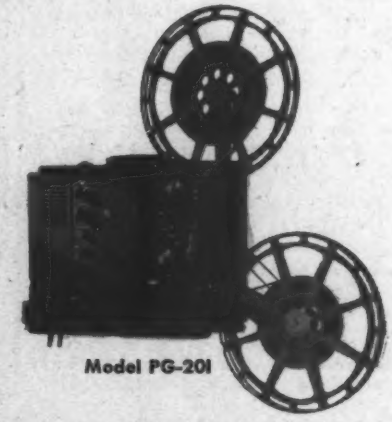

Model PG-201

RADIO CORPORATION of AMERICA

EDUCATIONAL DEPARTMENT, CAMDEN, N.J.

OBLIQUE LINES

Three problems, (only two shown here) in addition to the two offered in February, complete this group. Let your students work out the correct orthographic solutions.

To match the practicality of this course, equip your class with the most practical of drawing tools — TYPHONITE ELDORADO pencils with *easy* leads that neither feather nor crumble. Eldorado's uniformity in degree of hardness assures technique of line, which marks the good drawing.

The original drawn with Eldorado 2H and 3H.

SOLUTION: We'll be glad to send free Eldoradostats of these problems and solutions from which you can make blueprints for classroom distribution. Get your name on our mailing list by writing to the address below.

DIXON'S *TYPHONITE* ELDORADO

SCHOOL BUREAU, PENCIL SALES DEPT., 128-J3, JOSEPH DIXON CRUCIBLE CO., JERSEY CITY 3, N. J.

(Continued from page 26A)

7. 10 to 18 point
8. they may
9. ancient Egyptians
10. use to which they are put
11. because they are carried in pockets
12. No, leave *Mr.* off
13. No
14. add a little blue ink

Project No. 6. Menu

1. because menus are read in a subdued light
2. capitalize
3. a sheet folded from top to bottom, then side to side
4. wide margins, type in lower case, uniform spacing
5. no
6. long and important items should be centered; two or three short items of the same course may be grouped to fill a line
7. (See No. 4) Others may be: type used should be easy to read; liberal use of white space between lines.

Project No. 7. Program

1. capital; right
2. *a*) musical *b*) dance *c*) athletic *d*) graduation
   others: church, commencement, etc.
3. the name of the selection, and the composer
4. no, only open-period leaders are permissable
5. eggshell or lightweight cover stocks
6. ends should be tied at the bottom and a loop knot tied at the top of the program
7. four

Project No. 8. Announcement

1. yes
2. yes
3. first
4. *a*) formation of a business *b*) addition of a new representative
   others: receipt of a new line of products
5. white-wove, vellum-finish papers are best
6. *a*) white *b*) cream *c*) light buff d) French gray; others: pale blue, neutral gray, old rose
7. all caps
8. no

Project No. 9. Ticket

1. 3 ply
2. several layers of paper pasted together
3. named after a cardboard first made in Bristol, England
4. yes, required by the Collector of Internal Revenue
5. social, lecture, play, concert, dance, dinner, contests, etc.
6. easy
7. name of the event

Project No. 10. Envelope Corner

1. No. 6¾ and No. 10
2. to aid return of the letter by post office in case of nondelivery
3. platen
4. the top sheet of the tympan of a press
5. preparing impression before printing
6. it's faster
7. grippers
8. lighter
9. letterhead
10. 500

Project No. 11. Check or Receipt Blank

1. yes
2. voucher
3. no
4. safety
5. round-hole
6. yes

Project No. 12. Advertisement

1. difficult to read
2. copy
3. enclose the ad; draw attention to it
4. photographs
5. black and white drawings
6. sketch
7. (change rates for each student)
8. adman
9. 12 picas

Project No. 13. Color Chart

1. red, blue, yellow
2. yellow and blue; red and blue; red and yellow
3. the colored stock will show through; an opaque cover ink should be used on colored stock
4. darker color is added to the lighter base
5. *a*) pigment *b*) vehicle
6. black

Project No. 14. Shipping Tag

1. tough manila, jute, sulphite, rope, or cloth stock
2. the eyelets should be kept to the right
3. name and address of the sender printed above; those of the addressee at the bottom
4. eight
5. tend to slide off easily
6. manila and jute; others: red, green, yellow, blue, white
7. constant danger of damaging the form by slight misregisters in feeding

Project No. 15. Notebook Cover

1. above
2. scoring
3. oxidation; absorption (sometimes a combination of the two)
4. weight; bulk
5. antique, wove, plate, crash, ripple, various imitation finishes
6. *a*) pleasing appearance *b*) it should feel good to the touch *c*) it should fit the purpose (any other alternatives that prove justifiable)
7. wirestitching
8. shape

Project No. 16. Weekly Calendar

1. window card
2. cutting
3. Blind
4. without

(Continued on page 30A)

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PLASTIC CRAFT

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Written by teachers who introduced plastics work in the schools of New Jersey, this book presents the first complete, class-tested guide to shop and handcraft work in a highly rewarding medium. It includes all the necessary information about the various kinds of plastics suitable for school shop work—their characteristics, methods by which they may be worked, and where they may be obtained. It gives clear, illustrated directions for each operation and tool used in working plastics. New processes such as dip-dyeing and invisible cementing are included. It then gives step-by-step illustrated directions for making scores of plastic objects. These projects are suited to widely varying abilities and levels of skill, and include work for all types of shop—metal, wood and general. In addition, there is considerable work for students of fine art. The basic principles of good design are taught, and examples are given of the many possibilities for the use of fine art techniques on plastics. $5.00

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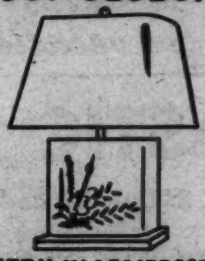
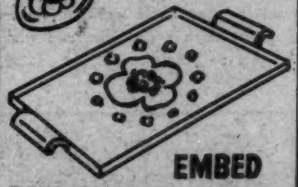


FERN IN LAMPBASE

NOVELTY JEWELRY



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Flowers, leaves and insects may be preserved in all their natural beauty in lustrous CASTOLITE. Makes ultra modern wall plaques and home decorations.

(Continued from page 28A)

5. Stiff job or bond
6. make-up

Project No. 17. Booklet

1. three or four
2. title line
3. cutoff
4. shape
5. dummy
6. caption
7. widow
8. Live
9. Solid
10. Overlay
11. folio

TEST FOR MECHANICAL DRAWING I

FREDERICK NEUSCHEL, JR.
Buffalo, N. Y.

Directions: If a statement in the following group is false, place an *F* in the space provided; if the statement is true, place a *T* in the space.

( ) 1. Mechanical drawing is a graphic language.
( ) 2. Mechanical drawing is the universal language of industry.
( ) 3. A mechanical drawing is more meaningful in industry than a picture of the object.
( ) 4. It is worth while to make a freehand drawing on notebook paper before making a mechanical drawing.
( ) 5. A mechanical drawing indicates the exact size of an object and all its parts.
( ) 6. A draftsman must be neat.
( ) 7. Freehand drawings should be reasonably accurate.
( ) 8. In industry ideas are first expressed in freehand sketches, later to be made into drawings.
( ) 9. A draftsman uses several grades of pencils.
( ) 10. A 3H pencil is harder than a 5H pencil.
( ) 11. An ordinary No. 2 pencil is often used when a soft pencil is needed.
( ) 12. A drawing pencil may properly be sharpened at either end.
( ) 13. Numbers and letters are used to identify the grade of a drawing pencil.
( ) 14. A draftsman uses two types of pencil sharpeners.
( ) 15. Center lines and dimension lines may properly be drawn with a 2H pencil.
( ) 16. A draftsman's pencil sharpener cuts away the wood and sharpens the lead in a pencil.
( ) 17. Horizontal and vertical guide lines for lettering are not necessary after we finish our letter plate.
( ) 18. Good lettering improves an otherwise poor drawing.
( ) 19. Vertical lettering is easier to read than slant lettering.
( ) 20. A 2H pencil is good for lettering.
( ) 21. All our lettering is done in capitals.
( ) 22. Lettering should be done slowly.
( ) 23. Guide lines should be erased from the drawing.
( ) 24. It is good practice to letter on notebook paper to obtain the correct spacing of the words and letters.
( ) 25. Letter spacing is easier than word spacing.
( ) 26. All letters are as wide as they are high.
( ) 27. The height of a fraction is twice that of a whole number.
( ) 28. Lettering requires constant practice.
( ) 29. Vertical lettering is more difficult to do than slant lettering.
( ) 30. Hidden lines are made up of short and long dashes.
( ) 31. Guide lines are medium in weight.
( ) 32. Arrowheads should be streamlined.
( ) 33. Projection lines are made up of short light dashes.
( ) 34. Extension lines have arrowheads on each end.
( ) 35. A pencil that is rotated occasionally remains sharp longer.
( ) 36. All long lines in mechanical drawing are made with instruments.
( ) 37. A ruler is the same as a scale.
( ) 38. The crossbar in a fraction should be parallel to the dimension line.
( ) 39. Extension lines should touch the view.
( ) 40. Parallel lines never meet.
( ) 41. Dimension lines should be drawn at right angles to the line being dimensioned.
( ) 42. Center lines are always drawn before circles.
( ) 43. Extension and dimension and center lines are light in weight.
( ) 44. The point of the pencil should be held close to the straight edge.
( ) 45. Contrasting lines are used in drawing.
( ) 46. The weight of a line refers to its degree of darkness.
( ) 47. Dimensions are placed on the views wherever it is convenient.

(Continued on page 32A)

WHEN SPACE IS AT A PREMIUM

New Improved Darra-James 12" Tilting ARBOR SAW

Darra-James have developed an outstanding tilting Arbor Saw for the industrial arts schools. This floor type saw is designed for rugged service with cast aluminum extension table that provides an overall working surface of 42" x 32" yet can be confined into a space 20" x 27". 95C — as shown with 3 extension tables, less motor, switch, blade, mitre extension, guard and splitter.

$295.00

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TABLE — Made of the finest gray iron. Main table is 20" wide, 27" long. Table size with extension 42" x 32". Extra deep (¾" x ½") accurately milled mitre gauge slots (one on each side of blade) prevents mitre gauge guide-bar from being forced out of slot.

TILTING AND ELEVATING UNIT — Controlled by positive nut and screw arrangement. This mechanism is of heavy gray iron construction carried by strong, long wearing, high grade nickel iron guides.

CAPACITY — Depth of cut using a 12" x ¾" bore blade 4".

HEIGHT — Table to floor 34"; Weight 430 lbs.

MOTOR MOUNT — Equipped with standard motor mount.

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EXTENSIONS — Three aluminum extension tables to relieve excessive weight on sides of main table (one) 15" x 32", (one) 7" x 32" for sides and (one) 20" x 5" for front or rear of main table.

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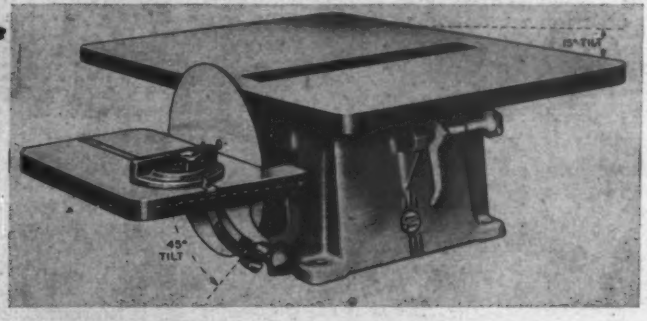

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- ★ Table may be raised or lowered for various depths of cuts.
- ★ Aluminum disc is adjustable to 45° — gives quick accurate angles.
- ★ Mitre gauge graduated through 120°.
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SPECIFICATIONS

- ★ Width of Drum, 9"; Diameter of Drum, 3⅛".
- ★ Diameter of Disc 8"; Drum Table 12" x 18".
- ★ Weight 25 lbs.

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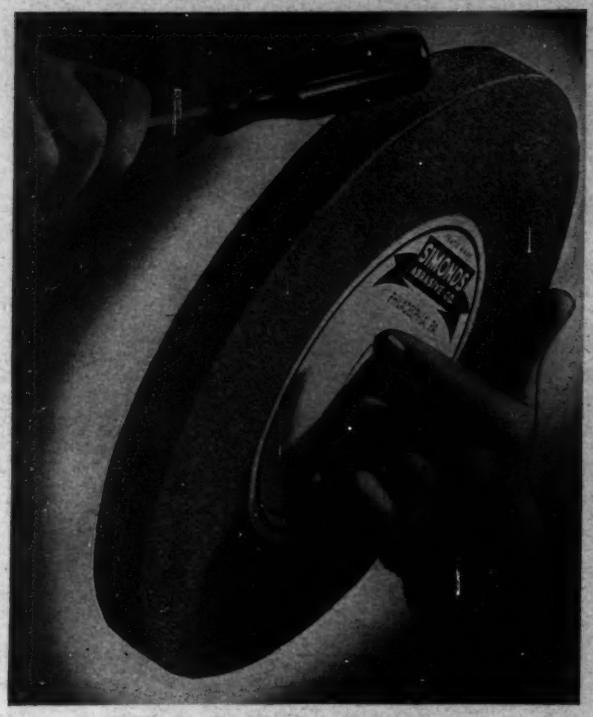

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(Continued from page 30A)

( ) 48. The top edge of the drawing paper is placed parallel to the lower edge of the T square when placing it on the board.
( ) 49. Scotch tape should be used only once.
( ) 50. As a rule the drawing paper should be near the top and left edge of the drawing board.
( ) 51. Drawing paper is cut perfectly square.
( ) 52. Once a drawing is started the same T square must be used until the drawing is finished.
( ) 53. The placement of the views on the paper should be computed before starting to draw.
( ) 54. A scale is often used to draw straight lines to correct length.
( ) 55. The bottom edge of a T square is never used to draw horizontal lines.
( ) 56. The head of a T square is always used on the left edge of the board if one is right handed.
( ) 57. It is permissible to use a T square as a straightedge.
( ) 58. A line which is perpendicular to another line is at right angles to that line.
( ) 59. All triangles contain 180 degrees.
( ) 60. A circle contains 360 degrees.
( ) 61. A celluloid edged T square is more accurate than a wooden edged T square.
( ) 62. Triangles and T squares should be wiped off before one starts to work.
( ) 63. When the head of a T square is placed on the top edge of the drawing board vertical lines may be drawn.
( ) 64. Dampness does not usually damage a drawing board.
( ) 65. A drawing board does not need to be square.
( ) 66. The drawing surface of a drawing board must be level.
( ) 67. Only one true edge is required on a drawing board.
( ) 68. Drawing boards are made of white pine or basswood.
( ) 69. The top surface of a drawing board is a plane.
( ) 70. The top view is always placed above the front view.
( ) 71. Sometimes the side view is placed under the front view if there is not enough room on the side.
( ) 72. Orthographic drawings have only two views.
( ) 73. A draftsman draws only enough views of an object to enable one to make the object.
( ) 74. Often only one view is necessary to make a drawing of an object.
( ) 75. Projection lines are always parallel.
( ) 76. Projection lines are at right angles to the plane of projection.
( ) 77. In a freehand drawing the views may be placed in any convenient position.
( ) 78. The front view of an object is often the clearest view of an object.
( ) 79. The views of a drawing are dependent on one another for dimensions.
( ) 80. One must study all views to get a picture of an object.
( ) 81. Objects are made from working drawings.
( ) 82. The ability to form a mental picture of an object is important in mechanical drawing.
( ) 83. In a freehand drawing the projection of the views must be the same as in a mechanical drawing.
( ) 84. Orthographic projection is used to describe the shape of an object.
( ) 85. The true surface of an object is seen when the object is at a 45-deg. angle to the plane of projection.
( ) 86. Three over-all dimensions are required in a drawing.
( ) 87. A working drawing is a complete drawing requiring notes and dimensions.
( ) 88. Dimension lines may cross.
( ) 89. All dimensions are often placed on one view.
( ) 90. In general it is best to place dimensions in the space between views.
( ) 91. The diameter of a circle is one half the radius.
( ) 92. Extension lines should not touch the views.
( ) 93. Dimension lines are placed parallel to the line being dimensioned.
( ) 94. Extension lines are placed at right angles to the line being dimensioned.
( ) 95. It should not be necessary for a workman to measure a blueprint.

KEY

1. T	6. T	11. F	16. F	21. T
2. T	7. T	12. F	17. F	22. T
3. T	8. T	13. T	18. T	23. F
4. T	9. T	14. T	19. T	24. T
5. T	10. F	15. F	20. T	25. F

(Continued on page 34A)

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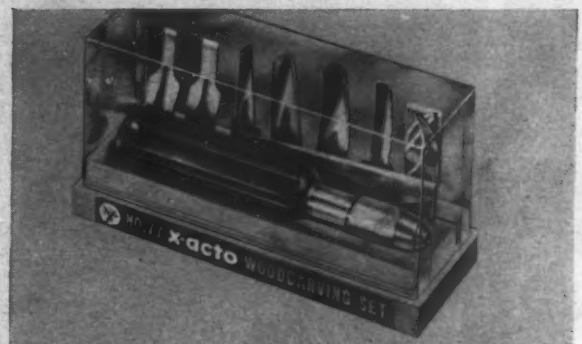

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BEGINNER'S LUCK — No. 81 X-acto Model-builder's Basic Kit. Includes 1 X-acto No. 2 Knife, 5 regular blades (assorted shapes), 1 3-in. saw blade, 1 3-in. whittler's blade, 1 block planer, 1 sander. In an attractive cardboard box, complete, $2.50

INEXPENSIVE, TOO!

X-acto offers a fascinating selection of sets and single items, ranging from the steel-handled beginner's knife at 25c to the super-de luxe "Toolmaster" Chest at $45. Shown are three handy sets for schools, hospitals and other craft-class groups.

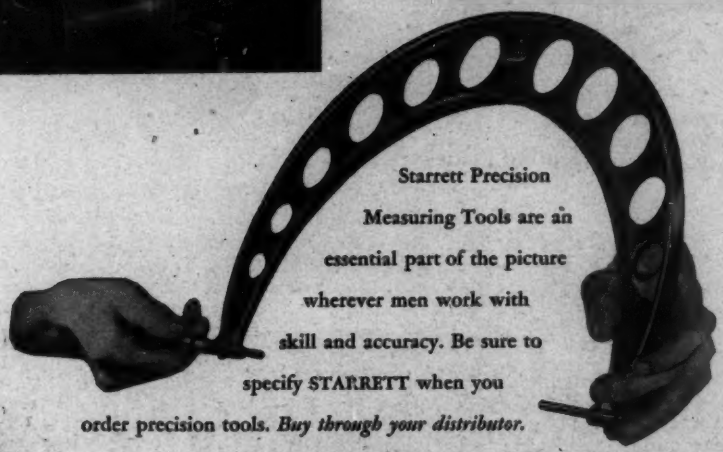
WRITE FOR SAMPLE OFFER AND PROJECT BOOKLETS

To school executives and teachers, writing on school letterhead, we will be glad to send catalog, sample offer and free copies of helpful booklets on model building, whittling, paper sculpture, art techniques, etc.

X-acto Crescent Products Co., Inc.
New York 16, N. Y.
In Canada: Handicraft Tools, Ltd., Toronto
*Reg. U. S. Pat. Off.

TO COMPLETE THIS PICTURE OF PRECISION . . . ADD A

STARRETT MICROMETER



Starrett Precision Measuring Tools are an essential part of the picture wherever men work with skill and accuracy. Be sure to specify STARRETT when you order precision tools. *Buy through your distributor.*

ADD THE STARRETT BOOK FOR STUDENT MACHINISTS, TOO

Full of practical, useful information about tools, machines and modern metal working methods, plus many handy reference tables, it's a great help to students and a handy reference for old hands. Only 75 cents per copy at your Starrett Tool distributors. Write for descriptive folder "CE".

THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U. S. A.

World's Greatest Toolmakers

STARRETT TOOLS

Precision Tools • Dial Indicators • Steel Tapes • Ground Flat Stock
Hacksaws • Band Saws for Cutting Metal, Wood, Plastics

(Continued from page 32A)

26. F	40. T	54. F	68. T	82. T
27. T	41. F	55. T	69. T	83. T
28. T	42. T	56. T	70. T	84. T
29. F	43. T	57. T	71. F	85. F
30. F	44. T	58. T	72. F	86. T
31. F	45. T	59. T	73. T	87. T
32. T	46. F	60. T	74. T	88. F
33. F	47. F	61. T	75. T	89. F
34. F	48. F	62. T	76. T	90. T
35. T	49. F	63. F	77. F	91. F
36. T	50. T	64. F	78. T	92. T
37. F	51. F	65. T	79. T	93. T
38. T	52. F	66. T	80. T	94. T
39. F	53. T	67. T	81. T	95. T

Directions: Fill in the blank with a word or figure which will make the statement correct.

1. General notes and dimensions are ..... inches high.
2. The type of lettering we use is called .....
3. Good lettering requires uniformity of ....., ..., ..., and .....
4. A drawing requires different kinds of lines to make it .....
5. Drawings to be blueprinted are made on ..... paper.
6. The T square is used to draw ..... lines.
7. The T square and triangle, when used together, are used to draw ..... lines.
8. The triangles used in class are called ..... and .....
9. The tool used for measuring is called a .....
10. The parts of a T square are called the ..... and .....
11. Each triangle we use contains a ..... degree angle.
12. Our drawing boards are made of ..... wood.
13. A plane is a ..... surface.
14. The height and length of an object are found in the ..... view.
15. The top view of an object shows the dimensions of ..... and ..... of the object.
16. The side view of a drawing shows the dimensions of ..... and .....
17. The top view of an object is drawn on the ..... plane.
18. The side view of an object is drawn on the ..... plane.
19. The front view of an object is drawn on the ..... plane.
20. The wire box used to explain orthographic projection is called a ..... box.
21. There are ..... planes of projection used in a three view drawing.
22. The ..... view of an object is always drawn.
23. The side view of a drawing is obtained by ..... from the front and top views.
24. The dimension of ..... of an object is found in the top and front views.
25. The dimension of ..... of an object is found in the front and side views.
26. The dimension of ..... of an object is found in the side and top views.

KEY

1. ⅛ inch	13. level
2. single stroke Gothic	14. front
3. weight, size, shape, slant	15. length and width
4. legible	16. width and height
5. tracing	17. horizontal
6. horizontal	18. profile
7. vertical	19. vertical
8. 30 by 60 deg., and 45 deg.	20. projection
9. scale	21. 3
10. head and blade	22. front
11. 90	23. projection
12. bass	24. length
	25. height
	26. width

JOE

LEONARD E. SCHMIDT
Lincolndale, N. Y.

That Joe was not the "usual" boy
I knew right from the start,
For the lessons that I daily gave
He seemed to take to heart.

To him each job was worth his best,
"Just anything" wouldn't do,
And there was little to find fault with
When a job of his was through.

Things came to Joe quite naturally,
He never seemed to try,
But if he wasn't sure, he'd ask,
"Please tell me how, and why?"

I don't know what became of Joe
He just never did write,
And though he left me long ago
I'm sure he's quite all right.

No, Joe was not the usual boy
And I wonder if someday, he
Will be thinking of some other Joe,
About the same as me.

Snap-on Tools

FIRST CHOICE ... of better mechanics! ... for sound training!

It is a well-known fact that Snap-on tools are the accepted standard throughout industry . . . and the choice of better mechanics, everywhere. Because of this, it is important that these same Snap-on tools be used in preparing students to take their place in industry . . . to help them be just as accurate . . . as adept . . . as proficient as their competing neighbors.

There is an outstanding story of quality behind Snap-on tools concerning engineered design . . . strength . . . balance . . . finish . . . etc. It is information that you should have. As a vocational teacher, you are entitled to the counsel and services of Snap-on's tool experts located in principal cities from coast to coast. Write for the Snap-on catalog and address of nearest branch.

Snap-on Tools
THE CHOICE OF BETTER MECHANICS

SNAP-ON TOOLS CORPORATION
8074-C 28th AVENUE KENOSHA, WISCONSIN

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — teacher's, and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¼- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking—Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, 1/3 pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/8 in. and 5/8 in.
- b) Cold, 5/8 in. and 3/4 in.
- c) Diamond point, 3/4 in. and 1/2 in.
- d) Roundnose, 3/8 in. and 1/2 in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes

COMBINATION SQUARES—with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting

DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to 1/2 in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to 1/2 in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, 1/2 in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

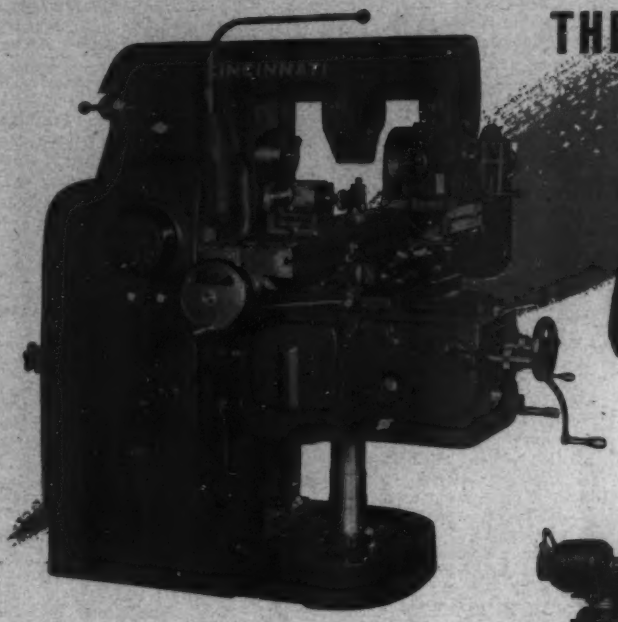
FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple, for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.

(Continued on page 38A)

THEY HAVE THE *Versatility* FOR A WIDE VARIETY OF SHOP ASSIGNMENTS



CINCINNATI No. 2 ML Universal Milling Machine. Catalog M-1507 contains complete details.

CINCINNATI

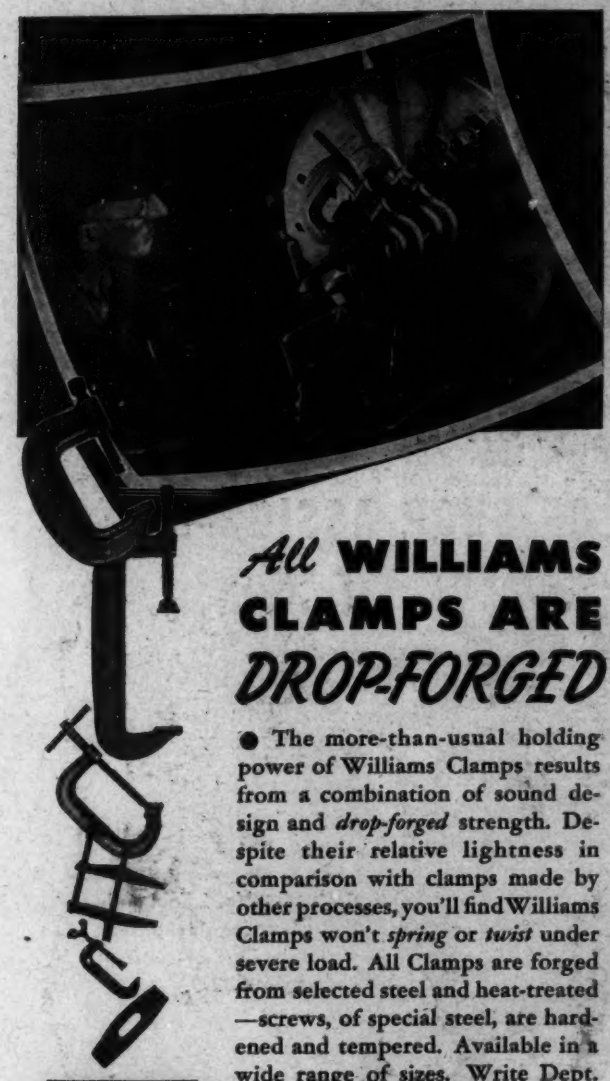
CINCINNATI No. 2 Tool and Cutter Grinder will sharpen a wide variety of cutters. Catalog M-962-3.

Your trainees gain the confidence that comes from actual experience only through contact with the proper equipment, which in turn presupposes a wide variety of shop lessons. In machine shop work, versatile machines are the answer. Three outstanding examples are shown here; (1) CINCINNATI No. 2 ML Milling Machine . . . for a variety of milling work, from cutting helical gear teeth to boring holes with fly cutters. (2) CINCINNATI No. 2 Cutter and Tool Grinder . . . for sharpening most of the cutters used in the average shop; milling cutters, planer tools, reamers, taps, etc. (3) CINCINNATI 12" Hydraulic Universal Grinding Machine . . . for all the variations of external grinding (straight cylindrical, taper, bevel, face), and for internal grinding. All these machines are safe and ruggedly built to withstand uncertain handling by students. You may obtain complete information by writing for the literature specified under the illustrations.

CINCINNATI 12" Hydraulic Universal Grinding Machine. Catalog G-1185-3 contains complete engineering specifications.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.



All WILLIAMS CLAMPS ARE DROP-FORGED

● The more-than-usual holding power of Williams Clamps results from a combination of sound design and *drop-forged* strength. Despite their relative lightness in comparison with clamps made by other processes, you'll find Williams Clamps won't *spring* or *twist* under severe load. All Clamps are forged from selected steel and heat-treated —screws, of special steel, are hardened and tempered. Available in a wide range of sizes. Write Dept. I-347 for descriptive literature.

Free DATA SHEETS

J. H. WILLIAMS & CO.
400 VULCAN ST., BUFFALO 7, N. Y.

Mailed postpaid on request — Order by number.

1. Data on "Superior" Wrenches.
2. Data on Boring Tools.
3. Data on Chain Pipe Tongs.
4. Data on "Supersocket" Wrenches.
5. Data on Lathe Dogs.
6. Data on Chain Pipe Vises.
7. Data on Turning Tools.
8. Types of "Superior" Wrenches.
9. Use of "Supersocket" Wrenches.
10. Data on Eye Bolts.
11. Data on "C" Clamps.
12. Use of Cutting-Off Tools.
13. Use of Knurling Tools.
14. External Thread Cutting.
15. Internal Thread Cutting.
16 to 21. Six Data Sheets on grinding cutters for Tool Holders.
22. Use of Open-end Wrenches.
23. Use of Lathe Dogs.
24. Use of Socket Wrenches.

(Continued from page 36A)

b) Blades, power, 14T, 12 in.
c) Frames, adjustable
HAMMERS
a) Babbitt
b) Ball peen, 13 oz., 16 oz., or 20 oz.
c) Blacksmith's, various kinds
d) Riveting, 9 oz., and 12 oz.
e) Setting
INDICATOR
a) Center
b) Universal or universal dial test
c) Speed
KNURLING TOOL — with assorted knurls
LADLES
a) Bull
b) Hand bowls
c) Melting
LATHE DOGS — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.
LEGGINGS — fireproofed duck, to protect students when pouring in foundry
LEVEL — 6-in. bench
LIFTING SCREWS — for molders
MALLETS — wood or soft
MANDRELS — selected sizes
MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.
MOLDING BOARDS
MOLDING STICKS AND TROWELS — various kinds
NIPPERS — end cutting, 5 in.
OIL STORAGE TANK — with pump
OILSTONES — medium and fine
PAILS — galvanized, 12-qt. capacity for foundry
PARALLELS
a) Adjustable
b) Steel, assorted sizes
PLIERS
a) Combination, 6 in.
b) Side-cutting, 6 in.
PUNCHES
a) Center, ¼ in. and ¾ in.
b) Hollow, ½ in., ¾ in., and 1 in.
c) Pin, ⅜ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
d) Prick, ¼ in.
RAMMERS — for foundry
a) Hand
b) Floor
REAMERS — various sizes
a) Adjustable
b) Hand
c) Taper pin
d) With taper shank
RIDDLES — ¼-in. and ⅜-in. mesh, 18-in. diameter, for foundry
RIVET SETS — assorted sizes
SCALES
a) Steel, 6 in., graduated 1/64 in. to ⅛ in.
b) Steel, 12 in., graduated to 32nds
SCREW DRIVERS — 6 in. and 9 in. blade
SCRIBERS
SHOVELS
a) Coke
b) Sand
SNIPS — tin, 3 in. straight and 3 in. curved
SOCKETS — for taper shanks, drill and tools, selected sizes
SOLDERING COPPERS AND HANDLES — 1-lb. size
SPRAY CAN — for molders
SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry
SPRUE PICKS — for molders
SQUARES
a) Machinist's, 6 in.
b) Blacksmith's
STEEL FIGURES, ⅛ in.
STEEL LETTERS — ⅛ in.
SWABS — for molders
TAPELINE — steel, 25 ft.
TAPS AND DIES
a) Machine screws
b) Pipe
c) N.F. ¼ in. to ¾ in.
d) N.C. ¼ in. to ¾ in.
TONGS
a) Blacksmith's, various kinds
b) Pick up, for foundry
c) Shake out, for foundry
TOOL HOLDERS
a) Boring tools
b) Cutting-off tools
c) Planer
d) R.H. and L.H. offset shank
e) Shaper
f) Slotter
g) Straight shank
h) Threading
TOOL-HOLDER BITS — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.
TRAMMEL POINTS
V BLOCKS AND CLAMPS
WHEEL DRESSER
WRENCHES
a) Adjustable, 8 in. and 10 in.
b) Pipe, 8 in. and 12 in.
c) Tap, adjustable, various sizes

Metalworking— Materials and Supplies

ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide
ABRASIVE WHEELS
ACETYLENE GAS — in drums for welding
ALUMINUM
a) Pigs for foundry
b) Sheets, tubing, rounds, shapes, wire, etc.
BABBITT METAL
BEARING BLUE
BELT DRESSING
BELT LACING MATERIAL
BELT LEATHER
BOLTS
a) Carriage, selected sizes
b) Lag, selected sizes
c) Machine, selected sizes
d) N.F., selected sizes
e) Stove, flat or roundheads, selected sizes
BRASS
a) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
b) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
c) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes

(Continued on page 40A)

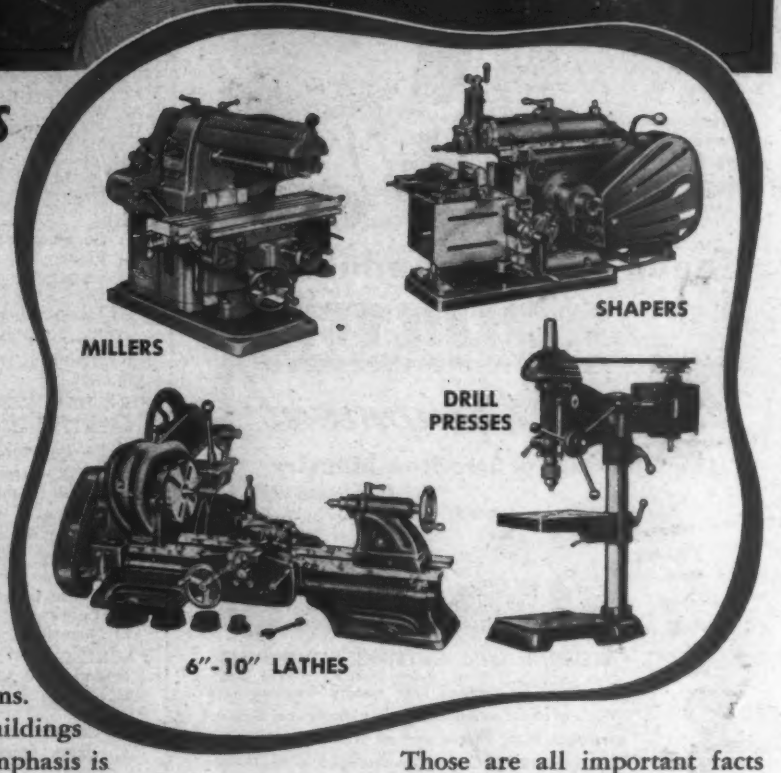
a few of the 30 Atlas Lathes in use at Hadley Tech. High School, St. Louis

MORE PUPIL STATIONS IN LESS ROOM AT LOWER COST

WITH

COMPACT, PRECISION

Atlas TOOLS



Close inspection of the busy shop scene above shows how Atlas tools solve some of today's major vocational education problems. Space is at a premium until new buildings can be built. Yet more and more emphasis is expected on practical skill instruction in shop classes.

Atlas equipment helps you master the situation. Atlas compact design gives you the greatest number of pupil stations in your shop space. The engineered precision and versatility of these compact tools enables you to demonstrate — and students to practice — every fundamental machining operation. The tools are ruggedly built to stand up under inexpert student use. Advanced production methods bring them to you at low cost to make the most of a limited budget.

Those are all important facts to keep in mind in planning your equipment needs for next term. Atlas tools ordered this Spring can be delivered in time for installation and use when school opens in the Fall.

SEND FOR LATEST CATALOG

This 64-page, completely illustrated catalog contains all the work range and tool specifications you'll need in making up your requisitions. Send for your copy today.

ATLAS PRESS COMPANY

371 NORTH PITCHER STREET • KALAMAZOO 13D, MICHIGAN

MARQUETTE
REGISTERED U.S. PAT. OFFICE
Instant arc A.C. WELDERS

Marquette 262 C Welders are built for heavy-duty production welding and are well adapted for 'round the clock instruction. Special transformer design gives "Instant Arc Striking" without high frequency or booster gadgets. Clearly marked heat stages simplify worksheet instruction . . . no confusing dials or controls to adjust.

Built-in Capacitor for High Power Factor. Telnic Bronze plugs and sockets double current carrying capacity in high heats. Generous use of aluminum increases transformer efficiency. Quiet in operation. No "Magnetic Blow." Low operating cost. Low maintenance cost. No moving parts to wear out or get out of order. Fully Equipped. 12 models 125 to 400 amps.

Use famous Marquette Electrodes in your classes. Buy the box . . . or buy the Ton!

Teach with Dependable
MARQUETTE
REGISTERED U.S. PAT. OFFICE
Welding Equipment
. . . the Standard of American Industry

MARQUETTE
REGISTERED U.S. PAT. OFFICE
WELDING and CUTTING EQUIPMENT

A Complete line of high quality Oxy-Acetylene Welding and Cutting Equipment, Acetylene Generators, Gas Rods, Fluxes and all Welding Accessories. There are 10 Outfits or Combinations to meet every need. No. 1 Outfit is designed to take all welding, brazing and cutting jobs in stride speedily and efficiently. Highest quality Oxygen and Acetylene Regulators. Self-aligning tips and needle valves. All vital threads and seats are fully protected by mixing section construction.

Sold Exclusively Through the Nation's Leading Distributors

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EQUIPMENT
A.C. ARC WELDERS · ELECTRODES
GAS WELDING and CUTTING EQUIPMENT
ACETYLENE GENERATORS · ACCESSORIES
MARQUETTE MFG. CO. INC.
MINNEAPOLIS 14, MINN.

(Continued from page 38A)

d) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
e) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
f) Wire, soft, 8, 11, and 14 American gauge, selected sizes
g) Wire, spring, 8 to 22 American gauge, selected sizes

CASEHARDENING COMPOUNDS

CHAPLETS — single and double head

COAL
a) Charcoal for foundry or forge
b) Coke for foundry
c) Forge

COPPER
a) Pigs, for casting alloys
b) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
c) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
d) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼, ⅝, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

CORE
a) Compounds
b) Flour
c) Paste
d) Oil
e) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — Pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
a) Boiled linseed
b) Lubricating
c) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — back asphaltum

PINS
a) Cotter, 3/32-in. to ¼-in. diam. from ½ in. to 2 in. long
b) Flask, for flask repairs
c) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

PUMICE POWDER

RIVETS
a) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
b) Iron, No. 14 gauge to 3/16 in., flathead or button head, ⅛ in. to 1 in. long, selected sizes
c) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
a) Molding, in 350-lb. barrels or 800-lb. casks
b) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
a) Flathead or roundhead iron or brass, selected sizes and kinds
b) Cap and machine, iron or brass, selected sizes and kinds
c) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
a) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4-ft. lengths, selected sizes
b) Bars, cold rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12-ft. lengths, selected sizes
c) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
d) Rods, hexagon and square, cold rolled, ¼ in. to ¾ in., in 12-ft. lengths, selected sizes
e) Round, cold rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
f) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
g) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
h) Threaded rods, Nos. 6 to 10, in 12-in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
a) Pigs, for casting alloys
b) 1C, 1X, 20 by 48 in.
c) 1XX, 20 by 48 in.

WASHERS AND BURRS
a) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
b) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
c) Brass washers, 3/16 in. to ⅝ in. by 16ths
d) Iron washers, 3/16 in. to ⅝ in. by 16ths

WELDING FLUXES

WELDING RODS (all rods come in 24-in. lengths)
a) Brazing, 1/16-in., ⅛-in., and 3/16-in. diameter
b) Cast aluminum, 3/16-in., ¼-in., and ⅜-in. diameter
c) Cast brass, 3/16-in., and ¼-in. diameter
d) Cast bronze, ¼-in. diameter
e) Cast copper, 3/16-in. and ¼-in. diameter
f) Cast iron, 3/16-in., ¼-in., 5/16-in., and ⅜-in. diameter
g) Low carbon steel, ⅛-in., ¼-in., and ¼-in. diameter

WHITE LEAD — for machine shop

WIRE
a) Annealed, 16 to 34 W and M gauge, selected sizes
b) Coppered market, 5 to 18 W and M gauge, selected sizes
c) Coppered spring, 2 to 18 W and M gauge, selected sizes
d) Galvanized, 5 to 18 W and M gauge, selected sizes
e) Piano, Nos. 2/0 to 36, selected sizes
f) Tinned, 16 to 24 W and M gauge, selected sizes
g) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

ZINC
a) Pigs, for casting alloys
b) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.

Kester in the classroom means *Income* in industry

Photo courtesy of Crosley Radio Corporation

KESTER CORED SOLDERS

Students taught soldering with Kester Cored Solder are trained for good paying jobs in industry. Soldering the Kester Way results in clean, tight solder bonds built to fit the fast-moving production methods of today and tomorrow.

The use of Kester Cored Solders sharply reduces waste in the classroom, eliminates flux splatters on walls, floors and equipment.

Virtually mistake-proof, the self-contained fluxes in Kester Solders make possible a clean, professional job that encourages the student — simplifies the work of both teaching and learning. Flux and solder are applied in one simple, time-saving operation. All Kester Solders form close, tight unions that hold tight against the toughest usage.

Use Kester Rosin-Core Solder for electrical work. It will not harm insulation nor cause corrosion. Kester Acid Core Solder produces the best possible results in all types of general soldering. Order from your supply house.

KESTER SOLDER COMPANY

4257 WRIGHTWOOD AVENUE, CHICAGO 39, ILL.

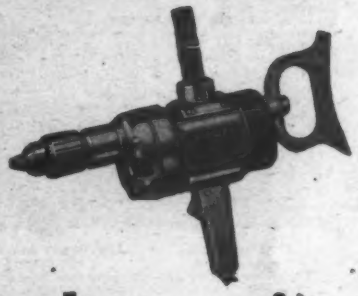
Eastern Plant: Newark, N. J. Canadian Plant: Brantford, Ontario

KESTER
FLUX-FILLED SOLDER

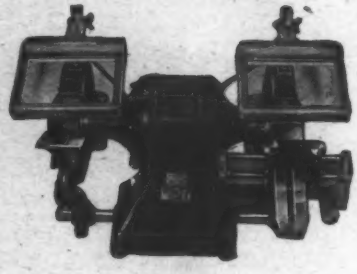
Put Skill in Student Hands

WITH STANLEY ELECTRIC TOOLS!

ELECTRIC DRILL No. 121. A powerful, light-weight tool for wood and metal drilling. ½" capacity. Sturdy construction and a well powered motor. Can be used with Stanley Bench Drill Stand No. 533 for a practical drill press. Other drills: capacities ¼" to 1".

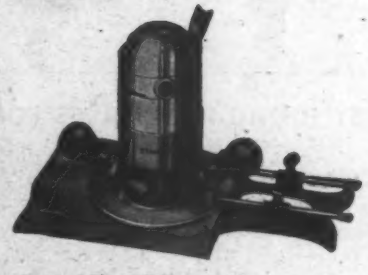


BENCH GRINDER No. 677. Ideal for school woodworking shops. Special ⅓ h.p. motor. "Flud-Lite" Eye Shields to protect operator. Lights go on and off with grinder switch. 7" x 1" wheels. Has patented attachment for grinding plane irons up to 2⅜" wide and any size chisel.



METAL CUTTING SHEARS No. 214 Unishear. Cuts up to 14 gauge steel 15 to 20 feet per minute, straight lines, curves, angles with hair-line accuracy. Light weight, easy to handle. Improved method of blade adjustment. Other Unishears cut 18 to 8 gauge steel.

ROUTER-SHAPER No. 10A. Will rout for inlays, do shaping, relief work, dovetails, carving, veining, template work, beading and fluting. Highly versatile. Change the bit and you change the tool, and you can add new bits as you need them.



Write for No. 67 general catalog and No. 607 Router-Shaper catalog.

Stanley Electric Tools, Educational Dept.,
112 Elm St., New Britain, Connecticut.

Remember To Specify

STANLEY
Trade Mark

HARDWARE HAND TOOLS · ELECTRIC TOOLS

The Greatest Name In Tools

ARMSTRONG

Quality TOOLS

ARMSTRONG TOOL HOLDERS Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED Ready-to-grind Bits... Ground Cutters. **ARMALOY Cast Alloy CUTTER-BITS** **ARMIDE Carbide-Tipped CUTTERS** 6 cutter shapes, 12 sizes—2 grades.

ARMSTRONG Turret Lathe and Screw Machine TOOL HOLDERS Drill Holders, Cutter Holders, Finishing and Knurling Tools for standard operations.

ARMSTRONG Drop Forged DOGS Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also Machinists' Clamps.

ARMSTRONG Setting Up Tools A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

ARMSTRONG Drop Forged Eye Bolts Plain or shoulder pattern. Blank or Threaded. 14 sizes, Drop Forged and heat treated.

ARMSTRONG Ratchet Drills All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

ARMSTRONG Drop Forged Wrenches Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating ... stronger.

ARMSTRONG Detachable Socket Wrenches All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

ARMSTRONG Machine Shop Specialties Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.

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SYNTHETIC RESIN GLUES FOR WOOD

JOHN PAUSTIAN
University of Nebraska
Lincoln, Neb.

Resin adhesives, or glues, for use with wood, represent a fairly recent development, having come into quite general use since the middle 1930's. Synthetic resins for wood were imported from Europe prior to 1935, and that year marks the beginning of their manufacture in the United States in quantities sufficient to assume commercial importance. Such quantities as were produced in the United States before 1935 were largely on a laboratory basis. By now, resin adhesives, or glues, as they might well be called for all practical purposes, have begun to displace the age-old animal gelatin glue in woodworking job plants. Hot-setting resin glues have displaced animal gelatin and blood-albumin glues quite generally in production plants where the cost of the necessary equipment is easily justifiable. Such items as plywood for exterior and interior use in either simple or compound curvatures, all types of aircraft plywood, wood propellers, ship keels, tubular plywood radio masts, prefabricated housing, radio cabinets, serving trays, etc., are better and far more durable when assembled with synthetic resins. In fact, synthetic resins have made most of these things possible.

Types of Synthetic Resin Glues

The synthetic resin glues for use with wood are of two general types: thermoplastic and thermosetting. As the name indicates, the thermoplastic resin glues are those which will soften in the presence of heat at suitable temperatures, and are therefore limited to uses which are not to be subjected to very much heat, or to such uses which will not be affected adversely by a slight softening of the glue line. Obviously, such applications are limited in number.

The thermosetting resin glues are those whose reactions are completed in the presence of heat; that is, they will cure and harden permanently when heat is applied, and are never resoluble. Temperatures higher than the setting-up temperatures will have no effect upon them, and they are equally resistant to moisture and fungus growths. Their resistance to weathering is very high; in fact, some of the thermosetting resin glues will outlast wood when wood so glued is exposed indefinitely to weather.

Synthetic resin glues are commonly classified as follows: *Thermoplastic resin glues;* polyvinyl acetate, polyvinyl butyral. *Thermosetting resin glues;* phenol-formaldehyde, urea-formaldehyde, resorcinol-formaldehyde, melamine-formaldehyde.

Thermoplastic Resin Glues

As indicated, the thermoplastic resin glues are principally the vinyl derivatives, polyvinyl acetate and polyvinyl butyral. These are marketed in liquid form, the solvents used being ethyl acetate, alcohol, or acetone. These same solvents can be used to bring the glue consistency to the desired point for a particular use. Heat must be employed to cure these resins in use, at temperatures from about 190 to 325 deg. F., depending upon the particular resin chosen. Heat causes the resin to soften, to flow, and to be absorbed by the wood. Joint strength develops during the cooling period. One of the objections to the use of thermoplastics is the fact that full pressure must be maintained through the cooling period, and this is not very economical in plywood manufacture.

Thermosetting Resin Glues

Phenol-formaldehyde has been found very successful as a resin for gluing wood, and was used first in the form of a film, know as Tego film. This consists of a sheet of very thin tissue paper, impregnated with phenol-formaldehyde resin. This impregnated paper film weighs about 12 lb. per sq. ft. Of this weight, about 65 per cent represents resin. Use of this film is probably the most convenient and economical method of phenol-formaldehyde gluing, since there is practically no waste involved, and the sheets are easily interleaved with sheets of veneer for plywood manufacture.

(Continued on next page)

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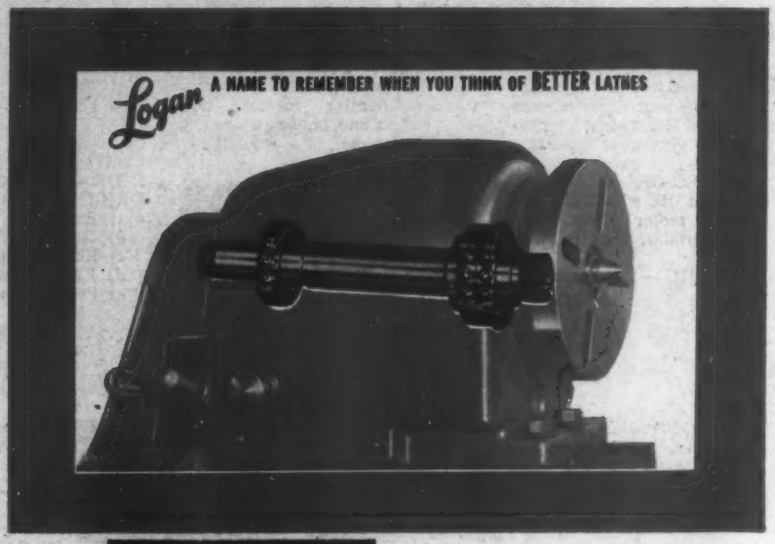
A pile of veneer sheets interleaved with Tego film in Dagwood sandwich fashion is placed between heated platens in a veneer press. The press must be closed immediately upon application of heat to avoid precuring or premature setting of the resin. The entire process occupies a matter of a few minutes. Wood so glued is absolutely waterproof — that is, there will be no failure at the glue line, even after prolonged immersion in water at any temperature. The platens used in such gluing operations have formerly been heated electrically or by steam. More recently, high-frequency induction currents have been used very successfully.

The process just referred to is known as the hot-press method, requiring temperatures ranging from 280 to 320 deg. F., and pressures varying from 100 lb. to 250 lb. per sq. in., depending upon the density of the wood being glued. There are two drawbacks to this method, namely, the cost of the necessary equipment and the cost of the resin glue. The need for using heat along with pressure could be considered another drawback, since it confines this resin glue to elaborate industrial installations. At present, the method is limited to plywood intended for use under conditions of extreme moisture-exposure.

Plywood glued by the above method is processed into aircraft structures by immersion in water at 190 deg. F., and subsequent shaping over heated forms until dry. A flat sheet so softened will withstand a fairly sharp bend to 60 deg., involving rather extreme tension and compression without rupture of the fibers.

The phenol-formaldehyde resin glues can be used with fillers and extenders. Common fillers are wood flour and walnut shell flour. They perform a very useful function wherever there is any tendency of crazing, or separation at the glue line caused by internal stresses or strains. The fillers will relieve these tensions by absorbing some of the strains. Extenders are just what their name indicates — substances used to extend a given amount of the glue over a wider area. Their use lessens penetration of the resin under heat and pressure. Resin glues prepared with extenders are limited to uses where shallower penetration will not materially reduce glue strength below actual requirements. The use of extenders results in somewhat lowered costs. Wheat flour is commonly used as such with the phenol-resins. It should be remembered that the use of wheat flour as an extender lowers the mold resistance of the finished product wherever conditions of high humidity and temperature obtain.

The phenol-resins are available also as liquids and as powders. The powdered form remains stable somewhat longer in storage, and is mixed with water or alcohol when readied for use.



BALL BEARING SPINDLE MOUNTING

PERMITS HIGHER CUTTING SPEEDS . . .
REQUIRES NO BEARING ADJUSTMENT . . .
SUSTAINS ACCURACY OF LOGAN LATHES

Quick Change Gear Cabinet Lathe

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½" . . . bed length, 43⅛" . . . size of hole through spindle, 25/32" . . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision ground ways, 2 V-ways, and 2 flat ways.

With its spindle turning on a pre-loaded ball bearing mounting of extreme precision, the Logan Lathe is inherently well adapted to accurate work at higher spindle speeds. This fact permits the use of high speed carbide cutting tools to full advantage. It assures a minimum of spindle deflection. And since no bearing adjustment is required within the full range of its speeds, 30 to 1450 rpm, the accurate factory alignment of the Logan Spindle remains undisturbed, and original accuracy is sustained. Grease sealed, the Logan Spindle Mounting never needs lubrication. All these characteristics are important factors in the proved ability of Logan Lathes to speed output and cut costs on production lines, and to do fast, accurate work in the tool room. See your Logan Lathe dealer, or write direct for the Logan Lathe catalog. M-2-M

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

The Urea-Formaldehyde Resin Glues

Rather early in the manufacture and use of phenol-formaldehyde resin glue, there developed a demand for a cheaper resin glue that would cure and set up at room temperature, with the result that urea-formaldehyde glue appeared about 1938. The urea-resin glue is marketed in either powder or liquid form, the powder containing a filler which may be either walnut shell flour or wood flour. Some urea-resin glues will set up at room temperature, and are known as cold-setting glues, while others require higher temperatures. The curing period of those setting at room temperature will be shortened considerably if the temperature can be raised to 90 or even 120 deg. Woods glued with urea-resin glue possess moisture resistance at the joint, but are not actually waterproof, as are joints glued with phenol-formaldehyde resin.

Resorcinol-Formaldehyde Glues

Resorcinol-formaldehyde glues are available in liquid form only, and require the addition of a catalyst before they are ready for use. The resorcinols will set at temperatures ranging anywhere from 70 to 200 deg. F. Setting will occur more rapidly with the higher temperatures. They

(Continued on next page)

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods

ANVIL
- *a*) No. 100 or No. 125
- *b*) Rim

ARMATURE GROWLER AND TESTER

AXLE STANDS

BATTERY EQUIPMENT
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

BENCH
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

BLACKBOARD

BLOWTORCHES — 1-qt. size

BOOKCASE

BRAKE
- *a*) Adjusting stand
- *b*) Band-lining machine

BULLETIN BOARD

CABINETS
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track

CHAIRS
- *a*) Teacher's
- *b*) For tables, or with tablet arms

CRANE — portable

CRANKSHAFT TRUING TOOL

CREEPERS

DESK — teacher's

DRILL
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ⅓ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

DYNAMOMETER — electric

FORGE — with blower and tools

FURNACES — gas

GREASE DISPENSERS

GRINDER
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

HONES — cylinder

JACKS
- *a*) Lever, 1½-ton
- *b*) Floor, roller

LATHE
- *a*) 11 in. by 4 ft., with motor, chucks, and attachments
- *b*) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- *a*) Arbor
- *b*) 30 ton

SPRAY PAINTING OUTFIT

VALVE REFACING MACHINE

VULCANIZER
- *a*) Electric steam for tube work
- *b*) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch

WHEEL ALIGNMENT
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

ABRASIVE — rubstone for cleaning castings in foundry

ALCOHOL TESTER

BATTERY
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *i*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

BITS
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.

CALIPERS — 6 in. inside and outside

CANS
- *a*) Oil, 1/3 pt.
- *b*) 1 gal., gas, safety
- *c*) 5 gal., gas, safety
- *d*) 5 gal., kerosine
- *e*) Waste

CHECKS — tool, 1000, blank

CHISELS
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, ¾ in., ⅝ in., ¾ in., 1 in.
- *c*) Diamond point

COMBINATION SQUARES — 12 in.

COTTER-PIN EXTRACTOR

DIVIDERS — 6 in. and 10 in.

DRILL SETS
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

FILE CARDS

FILE HANDLES — assorted

FILES
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid

FIRST-AID CABINET AND SUPPLIES

FLOOR BRUSHES — 18 in.

FUNNELS — tin, assorted sizes

GAUGES
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

GLASS CUTTERS

GOGGLES

GREASE GUNS — plain and pressure type

HAMMERS
- *a*) Ball peen, 4 oz.
- *b*) Ball peen, 1¼ lb.
- *c*) Ball peen, 2 lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

LADLE
- *a*) 3-in. bowl
- *b*) 6-in. bowl

LAMPS — extension, with reels

LEAD POT — gas

MAGNET CHARGER

METERS — volt and ammeter test

MICROMETERS
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

MOLDS
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

OILSTONE

PIPE TAPS — ⅛ in., ¼ in., ⅜ in., and ½ in.

PLIERS
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Roundnose

PULLERS
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

PUNCHES
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

PUTTY KNIVES

(Continued on page 46A)

(Continued from previous page)

are somewhat expensive, and are used largely for secondary construction, or assembly.

Melamine-Formaldehyde Resin Glue

The melamine-formaldehyde resin glues are the newest of all the synthetic resins, having appeared upon the scene since 1940. They are available in powder form, to be mixed with water and sometimes walnut shell flour as filler. Melamine resin glue is very similar to the phenolic-resin glues in behavior characteristics, in use, and in joint strength. Complete strength data are not yet available.

Compreg

A somewhat different use of synthetic resins than is evident in plywood and other resin-glued wood products, is shown in a recent development known as *Compreg* (from compressed and impregnated). Compreg consists essentially of a pile of laminated veneer sheets thoroughly impregnated with a synthetic resin, usually phenolic, and compressed between heated platens to about one half its original thickness. Heat from the platens (or possibly from high-frequency induction currents) penetrates entirely through the pile, cures the resin, and causes it to set up into a mass which is completely insoluble. As in gluing operations, the entire process occupies only a few minutes. The compreg process is distinguished from gluing however, because gluing involves neither impregnation nor compression.

By the compreg process, relatively soft, cheap, and unstable woods can be transformed into masses possessing very high dimensional stability. All untreated woods are hygroscopic, some reacting almost violently to humidity changes. The compreg treatment however, reduces this hygroscopicity almost to zero, even in the case of woods that formerly reacted almost instantly to moisture changes in the atmosphere. On a par with its high dimensional stability and high moisture resistance is its resistance to heat, and to mold and insect attack if protein fillers have not been used. The compreg process is very similar to the laminating process used in plastics manufacture, in which linen or canvas is used.

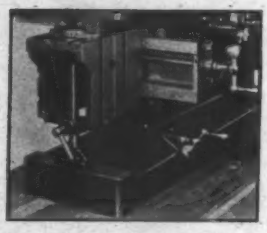
The finished product, after treatment as described, becomes very hard and heavy, and is difficult to machine with ordinary wood-cutting tools. Uses for compreg are being found continually, among them machine bearings, propeller blades and similar industrial applications. The material should lend itself well for use in mallet heads, forms for metal spinning, and for furniture and backing blocks in printing.

LOW PRICE Fits Every School Budget

Low in price, compact and space-saving in design, there is no big, expensive shaper that can beat AMMCO 7' SHAPER for accuracy and precision.

It handles a wide variety of work . . . is simple to operate. Boys take special pride in the craftsmanship it turns out . . . develop a new and lasting interest in self expression through good workmanship.

With special safety features, this is the ideal Shaper for school shop use. And at its new low price, it comes within the limits of your school budget. In bench or portable models . . . ready for immediate delivery! Write for specifications and low prices. Address Dept. IA-37.



Has "VEE" Type Ways, comparable to those of large, expensive shapers.

Portable Model is mounted on maple cabinet.

AMMCO TOOLS, INC.

COMMONWEALTH AVENUE — NORTH CHICAGO ILLINOIS

(Formerly Automotive Maintenance Machinery Co.)

THE SKILL IS BUILT INTO AMMCO MACHINES

(Continued from page 44A)

REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ½ in. to 1⅛ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS — 1, 2, and 3 lb. with handles
SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *j*) Valve-tappet wrenches

Automotive Shop— Materials and Supplies

ABRASIVE CLOTH AND PAPER — aluminum oxide and silicon carbide
ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
BOLTS
- *a*) Machine, selected sizes
- *b*) N.F., selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSINE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated, square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long.
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron, or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

THE USE OF GLUE IN WOODWORKING

WILBUR L. JONES
New York City

Glue is a substance which is always used in conjunction with water. The water is primarily a vehicle, since it merely carries the glue to the wood, allows it to be spread conveniently, and then disappears by evaporating. Although glue is in an aqueous medium not more than a few hours, those few hours are all important in determining whether the joint work will be well made.

Proportioning the glue and water correctly is the first step in intelligent utilization. The essential thing is to have a glue solution of the right consistency. Four different consistencies are met with in practice: one for heavy joint work, one for plywood manufacturing, one for boxmaking, and one for glue sizing. It would be impossible to treat of all four in a brief space; so let us consider just one — viz., that for plywood manufacture.

Any desired consistency can be obtained, when animal glue is used, by adjusting the amount of water or by selecting a different grade of glue without changing the water ratio. Adjustment of the water-glue ratio when no change of grade is involved is so simple as to require no comment. But when a new glue is brought into the factory, one often has a slightly different grade to deal with. That raises the question, what is grade and how does it affect solution consistency, and the gluing process in general?

It has never been sufficiently impressed upon the woodworker that the word *grade* is used by the glue manufacturer in a special and technical sense. Confusion arises from the free assumption that *high grade* is synonymous with *most desirable*. Sometimes this is true, but not always. The truth of the matter is that the desirability of any particular grade of glue depends upon the use to which it is to be put. Low grade glues are more desirable for certain purposes than the high grades are. The making of plywood is such a purpose.

Grade is a technical term referring to the particular system by which the glue manufacturer classifies his output. It was early discovered that animal glues varied widely in two properties, which, because they could be measured conveniently, were used as the basis of a system of classification. These two properties were viscosity and jelly strength. Therefore a high grade glue, as defined by the manufacturer, is one which has a high viscosity and a high jelly strength — in other words, a high test glue. Now the woodworker might perhaps, with equal propriety, designate a high grade glue as the one that serves his purpose best; but that would only lead to confusion, so it is best to adhere to the manufacturer's classification, remembering, however, that the word *grade* has a technical and not a general significance.

But one should not go to the other extreme and imagine that the glue manufacturer's use of the term *grade* is entirely arbitrary. There are very good reasons for believing that high grade — that is, high test — glues are more choice in some respects than low grades. For the most exacting kinds of joint work the use of a fairly high grade glue is to be recommended. But for certain other kinds of work a high grade glue is out of the question. To be explicit, a high grade glue is of little use to those who cannot arrange their work so as to have it ready for clamping in a very few minutes.

Since grade is in part a matter of viscosity, it is evident that a high grade glue has "body" — a rather indefinite term. Consistency is much better. At any given dilution a high grade glue has a heavier consistency than a low grade. By the same token, any given consistency can be arrived at either by putting a high grade glue into dilute solution or by putting a low grade into more concentrated solution. Although the consistency of animal glue solutions can be controlled in this way, their *setting* characteristics are not so easily manipulated. This will be explained when we come to the subject of jelly strength.

Different grades of animal glue require different amounts of water — assuming, of course, that all are to be brought to the same consistency. By skillful use of low grade glue one can prepare a solution of normal consistency and adhesive strength with an exceptionally low water content. The advantage of using such a solution is pointed out later on, in the discussion of the effect of water on thin veneers.

The woodworker may not know the exact grade he is using, but at least he should know the correct water-glue ratio for it. Although he can determine this for himself after a fashion, by rough experiment, he would probably do better to obtain it from the supplier of his glue.

(Continued on next page)

STOP SCHOOL FALLS

with FOOTHOLD SAFETY TREAD

Slipping, sliding, pitching, falling and all the thousands of school accidents they cause, can now be reduced instantly, positively, and cheaply without tear-up or tie-up. Built on the same principle as heavy duty, waterproof abrasive cloth, Foothold Safety Tread stops slipping as simply as sanding an icy road. Provided in roll or cleat form for instant application to any smooth, clean, floor surface, it permits waste-free, "pin-point" application to localized hazard areas on ramps, stairs, corridors, and shop walkways.

Quicker and easier to install than either mastic or metal flooring, Foothold Safety Tread has greater non-skid surface, and is fully effective when wet with water or oil. Completely waterproof and weather-proof, it resists oil, grease, alkalies and mild acids—and can be used immediately after laying.

Return the coupon for the special 12 Cleat Safety Kit—or write for descriptive booklet.

TO BEHR-MANNING...TROY, N. Y.
Please ship special FOOTHOLD SAFETY TREAD KIT containing 12 Standard Cleats 6" x 24", One Quart Foothold Cement and instructions for laying. Price $7.50.

SCHOOL NAME .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....
BY ..... TITLE .....

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

ALSO QUALITY COATED ABRASIVES SINCE 1872

(Continued from previous page)

Everybody who buys glue thinks earnestly about the price which he is asked to pay. Having been conscientious up to this point, many people grow careless when it comes time to mix water with it. Some do not weigh either the glue or the water. Apparently it has escaped their observation that mixtures containing too little water are inconveniently thick, hard to handle, relatively quick setting, and higher in spreading cost than they need to be. On the other hand, mixtures containing too much water are unnecessarily fluid. And because of their watery consistency they contribute to various gluing defects, through seepage and extrusion of a too fluid glue and through swelling and warping of the adjacent wood. The proper proportioning of glue solutions is elementary of course; yet it is surprising how often the elementary things are neglected.

Let us assume now that a solution has been correctly prepared, as, for example, by mixing 1 lb. of a No. 6 grade glue with 2 lb. of clean, cold water. This, after soaking and heating to 140 degrees F. should be at approximately the right consistency for veneering. The moment such a solution is spread on a piece of veneer, a number of things begin to happen simultaneously. The glue solution begins to lose moisture to the wood and to the air. The addition of water to the wood causes an appreciable swelling in every direction except parallel to the grain. The loss of water by the glue causes a gradual thickening of the solution. A more pronounced thickening is caused at this stage by the rapid fall in temperature of the glue, resulting eventually in the formation of a jelly. As a No. 6 grade glue has only to cool to about 70 degrees in order to become noticeably solid, it is evident that the gelatinization of a spread glue proceeds fairly swiftly. The rapid thickening and subsequent gelatinization of animal glue solutions are distinctly beneficial, because they are a guarantee that the glue will stay where it is put and not escape from the joint by running off the sheet or by seeping into the pores and ducts of the wood. They give promise too of a final solidity which will keep the glue in the joint when pressure is applied, even when that pressure, through accident or misdirected zeal, is in excess of the proper amount.

There is another side to these phenomena, though. The gradual gelatinization of the glue points to a need for haste, because the plywood must be in the press and the load applied before the glue has become completely solid, since it is obvious that a glue jelly cannot take hold on a fresh surface like a fluid glue. The condition of the wood should also give ground for concern, because it is swelling and perhaps curling in the meantime. The water which the veneer absorbs from the glue affects it profoundly; the thinner the veneer, the greater the effect. Veneers may absorb as much as 10 to 30 per cent of their weight of water — a moistening which may nullify the effect of their previous redrying. When moist veneers are glued they will be held in an expanded condition when the glue *sets*. This may be a contributing factor to warping of the panel. It may also cause the checking of the faces when the moisture absorbed from the glue escapes with consequent shrinking. Such considerations as these point out the urgent need for haste in getting veneered stock under pressure.

Gelatinization through cooling is a phenomenon which is peculiar to animal glue solutions. Although it is sometimes looked upon as a source of annoyance, it really constitutes the greatest advantage which animal glue has over its rivals. By requiring speed and precision in handling, it compels the plywood manufacturer to adopt the most approved methods of gluing. Delayed pressing, which clearly is harmful in the manufacture of fine plywood, is ruled out as a practical impossibility when animal glue is the adhesive. It is true that warm wooden cauls are sometimes used for the purpose of giving the veneering crew a longer working time. But the use of warm cauls often leads to their abuse, especially when they are heated above 120 degrees, in order to cover up inefficient methods or inexpert handling of the spread veneers. Used in conjunction with a jellied animal glue, warm cauls afford the best means of laying fancy (such as crotch and burl) veneers; but generally speaking, the application of overhot cauls is a thing to be avoided, since they nullify one of the most valuable characteristics of animal glue — namely, its ability to *set* quickly.

Animal glue solutions tend to gelatinize when their temperature falls to 60 to 90 degrees F. The variation which is seen here is due to differences in a previously mentioned test characteristic — namely, their jelly strength. The simple truth of the matter is that the jelly strength of a glue seems to measure its tendency to go into the jelly state when the temperature is low enough to permit

(Continued on next page)

Harper

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Harper Electric Kilns provide instructors with sturdy, dependable classroom equipment which can be operated with confidence. They are designed for firing the entire range of clays including the finest porcelains with temperatures up to Cone 13; for decorating with enamel and glazes on glassware and metals at low temperatures.

Hinged doors are convenient and easy to operate. Production can be doubled by adding a second kiln and operating it alternately from the same transformer.

Successful firing schedules can be repeated from term to term.

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1445 Buffalo Avenue
NIAGARA FALLS NEW YORK

(Continued from previous page)

it. The rate of setting is proportional to the speed at which the glue solution cools to a temperature at which it can gelatinize. The higher the jelly strength, the quicker it will "set," all other conditions being the same. The use of an exceedingly high grade — that is, a high test — glue is therefore out of the question in plywood manufacture. On the other hand, it would be poor policy to use one of the lowest grades obtainable, because the jellying tendency of animal glue, if not too pronounced, is one of its most valuable features.

To its tendency to go into a jelly on cooling animal glue owes its gradually increasing consistency, which helps prevent seepage, staining, and runoff. To that also it owes its eventual semijellied condition, which enables it to maintain itself in joints in spite of excessive pressures which might otherwise cause a "starved" (that is to say, a weakened) condition. To the same characteristic it owes that quickness of adhesive action which minimizes slipping in the press — a constant danger when glues which are thick for any other reason than gelatinization are loaded too suddenly.

The unique properties of animal glue therefore entitle it to consideration wherever the veneering department is organized for *speedy, efficient work*. Fancy veneers are its special province, as are all other kinds of veneer which are especially subject to staining and checking. Animal glue demands a quick, sure technique, which, however, is nothing more than the goal toward which all sound workmanship strives, no matter what the adhesive.

BEING RESOURCEFUL

DELMAR W. OLSON
Southern Illinois Normal University
Carbondale, Ill.

As much as we disliked Hitler and his policies, there is a lesson that we can well take from him — he was resourceful, almost beyond comprehension. Faced with a scarcity of many raw materials he invented substitutes. Having to do without certain products and materials, many of his production machines became idle, but he quickly adapted these machines to fit new products. Substitutes for basic materials and synthetics for natural materials were problems that were successfully solved by German engineers during this period of militarism. Scrap materials, once discarded, were converted into necessities to the extent that now scarcely any scrap materials as such may be found in the Reich.

We read of food concentrates being fed his soldiers, of imitation leather made into shoes, of aviation fuel made from potatoes, of synthetic and reclaimed rubber, of plastics made from agricultural products, of synthetic cottons and silks. Hitler had to use what materials he had to produce the essentials needed in a wartime economy. No one questions the degree of success he achieved by this means.

We industrial-arts teachers today are still faced with the problem of securing materials, tools, and machines to carry on our work, even though World War II has been ended for over a year. Metals are still difficult to obtain. Paints and finishing materials are still largely in the substitute stage. In fact, the list of hard-to-get materials still looms large.

With the shortage of so much of the material that is vitally needed in our industrial-arts shops, and confronted with the fact that there is an acute teacher shortage, there seems to be a feeling of retrenchment in some quarters — a feeling that industrial arts, because it requires materials as educative media, must be condensed, compressed, abbreviated, and even curtailed. This may be a logical conclusion, but to industrial-arts teachers who really see a program of general education in their offerings, this dilemma becomes a challenge. It is a challenge to them to show the quality, the spirit which marks our educative program.

The question then arises, "what can the industrial-arts teacher do to keep his shop in full production when regular materials are cut off?" There is one answer — resourcefulness. Resourcefulness may take many forms. Wherever it may lead in terms of program and pupil activities, it will require that the industrial-arts teacher re-examine his subject matter. This re-examination will show possible directions, one of which may be that of the pupil delving deeper into the study of his problems than has been done in the past. In this case greater emphasis may be placed on so-called related information and research by the pupil. More time may be given to individual conferences in the interests of guidance — personal, social, economic, vocational, and recreational.

One thing that we can do for our students is to help them to stay in school as long as possible. Let there be more than ever, socially desirable purposes for their schoolwork. Industrial arts can and must meet new challenges if the bumps over which we shall bounce within the next few years are to be made more smooth.

Wood is probably harder to get right now than during the war. We must, therefore, be resourceful. We must adapt our wood projects to fit the wood available in particular situations. It might mean that our wood projects would have to be changed to use less material. Wood carving with its application of art and design would be a logical area of work. It is adaptable to both hand machine processes and has much to offer to both the beginner and the advanced student.

Wood as a medium for applied art offers unlimited possibilities. Costume jewelry and novelties, for example, expressive of art and design of the American Indian, the Mexican, the Chinese could keep a class busy indefinitely, and with wood from the scrap box.

Scrap wood material is still plentiful and from such it is fun to construct useful

(Continued on page 50A)

ONE THING IN COMMON QUALITY
MILLERS FALLS
TOOLS
SINCE
1868
ALL YOU NEED TO
KNOW ABOUT TOOLS
Your best assurance of complete satisfaction in the tools you teach with is the Millers Falls trademark with its famous slogan. This trademark of *quality* represents the finest in hand tools, portable electric tools, hacksaw blades, metal cutting bands, machinists' and precision tools . . . tools that have stood the test of time in the hands of countless instructors, students and craftsmen alike.
Though their supply has been short, the quality of Millers Falls Tools has remained constant . . . and progress is being made towards increased production. Make *your* teaching job easier and more effective. Ask your supplier or write to us for full details about this extensive line of quality tools.
ONE THING IN COMMON — QUALITY!
MILLERS FALLS COMPANY
Greenfield Massachusetts

Electrical-Shop Equipment, Supplies, and Motor Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH GRINDER
BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- a) Auger, ¼ in. to 1 in. by 16ths
- b) Auger, 11/16 in., 18 in. long
- c) Drill, for wood, square shank, ⅛ in. to ½ in. by 16ths
- d) Expansion
- e) Extension, 18 in.
- f) Screw driver, ¼ in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- a) Spreader
- b) Taper
- c) Winder

DESK — teacher's, with drawer compartments
DRILL
- a) Breast
- b) Concrete, ¾ in., ½ in., ¼ in., 1 in.
- c) Hand
- d) Portable, electric
- e) Twist, 1/32 in. to ¾ in. by 32nds

DRILL PRESS
- a) Bench, hand, or power driven
- b) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- a) Blades, 10 in., 24 tooth
- b) Frames, adjustable

HAMMERS
- a) Claw, 12 oz.
- b) Machinist's, ball peen

HICKEY — ½ in. and ¾ in.
LATHE
- a) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- b) Speed

PLIERS
- a) Gas, 6½ in. and 8 in.
- b) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- a) Pipe burring, ¼ in. to 1 in.
- b) Pipe burring, ½ in. to 2 in.

RULES
- a) 48 in. zigzag
- b) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- a) Assorted
- b) Electric
- c) Handles

STOCKS AND DIES — for pipe threads, ½ in. to 1 in.
VISES
- a) Machinist's, 4 in.
- b) Pipe

WRENCHES
- a) Adjustable, 6 in. and 8 in.
- b) Pipe, 10 in., 12 in., and 14 in.
- c) Socket, combination

Electrical Shop—Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1½, and 2 in. wide
ARMORED CABLE
- a) 2 wire, No. 14, single strip
- b) 3 wire, No. 14, single strip
- c) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — ¾ in., No. 19, and 1½ in., No. 16
BRAKE LINING — ¼ by 2 in.
BRUSHES — carbon, for motors and generators
BURGLAR CONTACTS
- a) Open circuit
- b) Closed circuit

BUSHINGS
- a) Loom, No. 1 and No. 2
- b) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- a) Bushings, ½ in., ¾ in., and 1 in.
- b) Box connectors, for flexible
- c) Couplings, for flexible
- d) Lock nuts, ½ in., ¾ in., and 1 in.
- e) Rigid, ½ in., ¾ in., and 1 in.

CONDULET
- a) Fillings, ½ in., LL, LR, and LB
- b) Covers, ½ in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- a) Plug type, renewable, 125 volt, 15 amp.
- b) Cartridge type, renewable, 125 volt, 30 amp.
- c) Renewals for plug fuses
- d) Renewals for cartridge fuses

GROUND CLAMPS — ¾ in. to 1 in., assorted
HICKEY GRIPS — ½ in. and ¾ in.
LAMPS
- a) Carbon, 220 volt, 60 watt
- b) Mazda, selected as wattages and voltages
- c) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- a) Metal
- b) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, ¾ in., ½ in., ¾ in., and 1 in.
PUSH BUTTONS
- a) Return call, 3 point
- b) Single

RECEPTACLES
- a) Flush, duplex
- b) Porcelain cleat, 660 watt, 250 volt
- c) Concealed
- d) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- a) Compression, 275 watt
- b) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- a) Anchors, 8/32, 10/24, 12/24, 14/20
- b) Machine, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ¾ in., 8–32 by ½ in., 8–32 by 1 in., 10–32 by ¾ in., 10–24 by ¾ in., 10–24 by ¾ in., 10–32 by ¾ in., 12–24 by 1 in.
- c) Machine, brass, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ½ in.
- d) Wood, flathead bright, No. 5 by ¾ in., No. 8 by ½ in., No. 8 by ¾ in., No. 8 by 1 in., No. 7 by 1½ in., No. 8 by 1½ in., No. 7 by 2 in.
- e) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1½ in., No. 10 by 1½ in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- a) Brushed, brass pull chain, keyless, key
- b) Porcelain, keyless, with caps
- c) Porcelain, key, with caps

SOCKET CAPS — ¼ in. and ⅜ in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2 oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.

(Continued on page 52A)

(Continued from page 48A)

articles. Chairs from barrels, tables from nail kegs, soapbox racers from boxes are typical ideas. As a matter of fact it is now a good time for us to find out just what the subject matter content of woods can be. It is doubtful if any of us have exhausted more than a fraction of the possibilities for pupil experiences in the field of woods.

Metals are becoming more available, but even if they are, it is well to remember that some pieces of salvaged brass and copper can keep a group busy for a long time when the students turn them into dress ornaments that are now so popular. Scrap iron and steel also are available, and almost every farm has a junk pile and every town a junk yard. Smaller projects and those involving a minimum of material may be devised which will still offer many learning opportunities.

Textile materials, such as cotton and wool, may also be salvaged and used. A discarded woolen sweater can supply enough yarn to weave several neckties or purses. Discarded wrapping string can be used as warp for many weaving jobs. Weaving in the patterns and methods of the Navajos or the colonists can become a rich experience. Looms can be constructed by the students and the entire process from weaving design through loom design and construction can be studied.

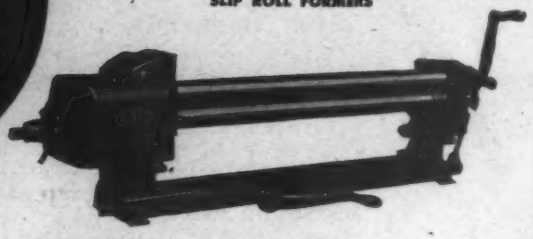
Ceramic materials are plentiful. Pottery and modeling may well be explored more deeply than we have done in the past. Work with cements and plasters in cast, turned and carved projects offer a wide field of exploration.

In our electrical and radio work we may have to save the spilled bits of solder and re-use our copper wire. Discarded radios, electric stoves, electrical appliances, auto-

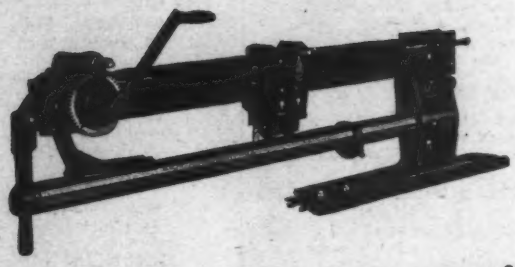
(Continued on page 54A)

PEXTO GETS THEM THERE FASTER AS SHEET METAL WORKERS

SLIP ROLL FORMERS



COMBINATION ROTARY MACHINES

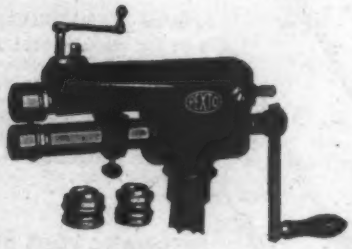


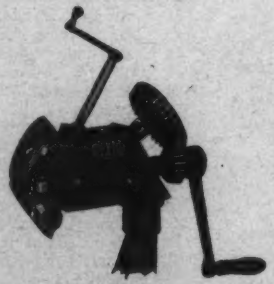
GROOVING MACHINES

The student who has learned his trade with PEXTO Machines and Tools for modern Sheet Metal Fabrication will meet them again as old friends when he moves on to his "qualified-worker" job.

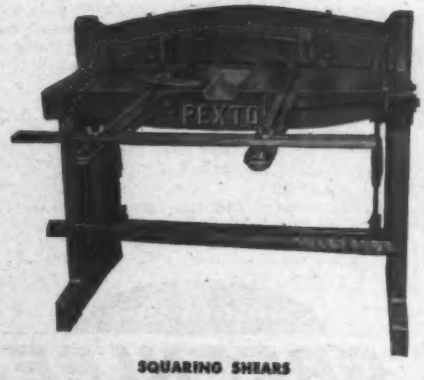
Shown here are a few typical machines of the Sheet Metal Worker's Craft. Ask us for full details when planning for shop equipment.

BEADING MACHINES





SETTING DOWN MACHINES



SQUARING SHEARS

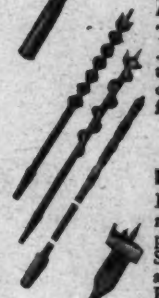
THE PECK, STOW & WILCOX COMPANY Since 1785 SOUTHINGTON, CONNECTICUT, U. S. A.

Greenlee

HAND TOOLS FOR THE CRAFTSMAN

CHISELS AND GOUGES

For all types of woodworking . . . GREENLEE chisels and gouges of crucible steel provide tough, lasting, fine cutting edges. Various types of socket, tang butt and firmer chisels, gouges and turning tools.



AUGER BITS AND DRILLS

There's a GREENLEE for every need . . . all types of twists and heads. Cutting parts precision-sized to indicated diameter, true-square shank tapers, filed-sharp edges.

EXPANSIVE BITS

For fast, uninterrupted cutting . . . newly-designed wide, open throat for positive chip clearance. Two styles: Set-fast Expansive Bit with quick adjusting-locking feature and Plain Expansive Bit.

SPIRAL SCREWDRIVERS

Built for years of hard service, the GREENLEE Spiral Screwdriver incorporates special, long-lasting, phosphor bronze drive nuts to withstand heaviest wear. Adjustments are quick, simple, positive. Available in small, medium and large sizes—with or without spring return.

AUTOMATIC PUSH DRILLS

Completely enclosed working parts keep out dirt and grit. Hardwood handle serves as readily-accessible magazine for 8 drill points supplied. Constructed with special phosphor bronze drive nut for long wear.

The GREENLEE Line also includes razor-blade draw knives, bit extensions and other high-quality tools for the woodworking craftsman.

For complete information on GREENLEE tools, write Greenlee Tool Co., Division of Greenlee Bros. & Co., 2023 Twelfth Street, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

(Continued from page 50A)

STARTING BOXES
- a) For compound motors, various makes
- b) For shunt wound, 1 h.p., 110-volt motors. Overload release
- c) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- d) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt

SWITCH
- a) Battery, 4 point
- b) Bases, porcelain, for 10-amp. switches
- c) Boxes, 2¾ in. deep
- d) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
- e) Entrance, safety, 3 pole, 30 amp., 250 volt
- f) Flush, push button, S.P., D.P., 3 way, 4 way
- g) Surface, S1, S3, and S4
- h) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- i) Surface, snap, electrolier
- k) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required

TACKS — double-pointed No. 10

TAPE
- a) Friction, ½-lb. rolls
- b) Rubber, ½-lb. rolls

TELEGRAPH SETS — including sounders, keys, and relays

TELEPHONES
- a) Complete bridging, independent phones
- b) Couch vestibule telephones
- c) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

TRANSFORMERS
- a) Bell ringing, 6, 8, 14 volt
- b) Single phase, 110–220 volt, S.K.V.A.

TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.

TUBING — flexible nonmetallic, ⅜ in. and ⅝ in.

WASHERS
- a) Iron, ⅛ in. and ¾ in.
- b) Brass, ¼ in. and ⅝ in.

WIRE
- a) Annunciator No. 18 or No. 20
- b) Fixture, No. 18, single yellow, with marker
- c) Rubber covered, solid copper, No. 10, black
- d) No. 10, white
- e) No. 14, black
- f) No. 14, white
- g) Rubber covered, No. 16, brewery cord
- h) No. 18, lamp cord, green and yellow
- i) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop—
Motor and Testing Equipment

ANNUNCIATORS
- a) Automatic needle drop
- b) Gravity drop
- c) Manual needle drop

ARMATURES — burnt out, for repairing

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- a) Air, single pole, overload, 25 amp., 550 volt
- b) Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- a) For multiple-speed motor
- b) For 1 h.p., 110-volt series motors

GENERATORS
- a) Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- b) Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- c) Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- a) Ammeter, standard, 60 amp., a.c.
- b) Ammeter, standard, 60 amp., d.c.
- c) Ammeter, student, 60 amp., a.c.
- d) Ammeter, student, 60 amp., d.c.
- e) Voltmeter, standard, 0–10 volt,
- f) Voltmeter, standard, 110–220 volt, d.c.–a.c.
- g) Voltmeter, standard, 125 volt, a.c.
- h) Voltmeter, standard, 125 volt, d.c.
- j) Voltmeter, student, 110 volt, d.c.
- k) Voltmeter, student, 110 volt, a.c.
- l) Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- m) Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- n) Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- a) Auto starter, different makes
- b) Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- c) Compound, 1 h.p., 110 volt, d.c.
- d) Multiple speed, 1 h.p., 3 phase, 220 volt
- e) Series, 1 h.p., 110 volt, d.c.
- f) Shunt, 1 h.p., 110 volt, d.c.
- g) Split phase and repulsive, a.c., 110 volt, single phase, assorted
- h) Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- j) 3 phase, 1 h.p., a.c., 220 volt, various makes
- k) 3 phase, 2 h.p., 220 volt, a.c., various makes
- l) Universal, fractional h.p., 110 volt, different makes
- m) Universal, variable speed, ½ h.p.

PLATFORM SCALE — 100 lb. capacity

Crescent Saw Table is available also with divided table top having traveling left-hand section.

Saw-guard lifted to expose saw blade and splitter. Ripping fence and cut-off gauge are shown also.

CRESCENT builds a complete line of woodworking machinery:

Planer

Mortiser

Shaper

Disk Sander

Band Saws (20" — 32" — 36")

Jointers (8" — 12" — 16")

CRESCENT SAW TABLE

Tilting-table unit is vibrationless . . . combines utility and convenience

OPERATING advantages like these (to mention just a few) justify your good judgment in specifying Crescent Saw Tables on your requisition for woodworking machinery:

(1) One-piece, cored-out, heavy cast iron base rigidly supports built-in motor.

(2) Arbor is mounted in precision ball bearings which are enclosed in dust-proof housings.

(3) Table tilts to an angle of 45°; it firmly locks in any position. Graduated scale and pointer indicate degree of angle.

(4) Ripping fence tilts to an angle of 45° to the right; it can be used on either right or left side of saw.

(5) Cut-off gauge adjusts to 45° for right or left mitering.

(6) Motor control and other adjustments are conveniently located at front of machine.

These features result from Crescent's more than fifty years' experience in designing and building woodworking machinery.

Standard equipment for the Crescent Saw Table includes safety guard, ripping fence, cut-off gauge, one saw, mandrel wrench, and saw splitter.

Select shop equipment that provides students with real production training, on machines well-known in the woodworking industry for high performance standards. Specify Crescent Saw Tables.

Crescent Manufacturing Division
Rockwell Manufacturing Co.
Leetonia, Ohio

CS-3

FREE! — Catalog of Crescent Woodworking Machinery, illustrates and describes the entire line in detail. Organized to give you quickly the information you need, to do an intelligent job of selecting equipment. Use coupon at right to request yours.

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Send me, without obligation, a free copy of the Crescent Woodworking Machinery catalog.

Name.....

Position.....

School.....

Address.....

City.....(....) State.....

Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

BLACKBOARD — permanent or portable

BOOKCASE

BULLETIN BOARD

CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.

CHAIRS — teacher's and tablet arm

CORE OVEN — for patternmaking class

DESK — teacher's, with drawer compartments

FURNACE — for melting soft metals (for patternmaking class)

GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat

GLUE WARMER OR COOKER — 1- to 5-gal. capacity

GRINDER
- *a*) Automatic knife, direct-motor-type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbetting. Safety-cylinder type, equipped with safety guard
- *b*) 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbetting. Jointer to be equipped with safety guard

LATHES
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

SANDER
- *a*) Belt, direct motor drive
- *b*) Disk, motor or belt driven
- *c*) Oscillating spindle, motor driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical spindle and disk sander

SAWS
- *a*) Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct motor or belt driven
- *f*) Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g*) Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 to 16 in., motor driven
- *i*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cutoff gauges

SHAPER
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw

VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.

WOOD TRIMMERS — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

AWLS — brad, assorted sizes

BEVELS
- *a*) Protractor
- *b*) Sliding T, 8 in.

BITS
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅞ in. to 1½ in.
- *g*) Expansive, ⅜ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ¾ in., inclusive, by 32nds

BLOWTORCH

BROOMS

BRUSHES
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round

CAN OPENER

CARVING TOOLS
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

CHISELS
- *a*) Cold, machinists', ⅜ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c*) Socket firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d*) Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e*) Tanged firmer, bevel edge, ⅛, ¼, ½, ¾, 1, and 1¼ in.

CLAMPS
- *a*) Bar, 24, 36, 48, and 60 in.
- *b*) Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.

(Continued on page 56A)

(Continued from page 50A)

motive equipment, will supply many of the materials needed. An old storage battery can be overhauled to provide inexpensive current. It can be charged by a secondhand auto generator.

Craftwork offers unlimited possibilities with inexpensive materials. Corn and pumpkin seed necklaces are still popular with the smaller girls. Sliced black walnuts strung on shoestrings make attractive belts. Bolero jackets from feed and burlap sacks, embroidered in brightly colored yarns, are fun to make. Old leather boots and jackets are a good source of leather. Although not toolable, ornamentation can be added to the leather by enameled, lacquered, pierced, and overlaid designs.

Musical instruments can be designed to fit the abilities of almost any pupil. Xylophones from three or four notes to several octaves are possible. Scrap wood, metal, or glass may be used in making the bars for this instrument. Mailing tubes will do for resonance tubes. Flutes can be made from bamboo fishpoles. Ukuleles from cigar boxes with one to four strings are easy to make. Rattle bones and castanets will add special effects. Chimes can be made from old pipes. Every pupil knows of Bob Burns's bazooka. It would be great fun to devise such unorthodox instruments. Hillbilly bands capitalize on them.

It would be quite impossible to list all the things that could be done by a resourceful teacher and his pupils. The fact that it is looked upon as being impossible makes it all the more interesting because it gives everyone so much opportunity to do something creative that hasn't been done before.

Now is the time to broaden industrial-arts subject matter rather than to constrict it. Materials will always be available for resourceful teachers and pupils. It means an examination of our present work with an eye to what might be done. It is a wise teacher who takes this problem of limited materials to his students. Solving the problem co-operatively will bolster the general morale. Imagine the excitement wrapped up in a group project centering on "the making of something out of nothing."

(Continued on next page)

(Continued from previous page)

Materials will always be available to the resourceful teacher and his pupils.

We in industrial arts during these times have really more to do than ever before. We have a responsibility to our boys and girls and to our nation for increasing our services rather than curtailing them. Ours is one of the few really functional, educational programs in the whole public school system. Let us more than ever make meaningful the experiences our pupils have in the shop. Let us proceed in the direction of our goals, but let us interpret them that they do the greatest good. Let us try to find what the needs of our boys and girls are today in the light of the present, and then let us project our thinking in the direction of those needs a few years hence. That done, then let us muster all the ingenuity, all the resourcefulness, that rightfully characterizes the industrial arts and strike out for new horizons of service whether we have well stocked supply rooms or not.

Personal News

♦ VERNE L. PICKENS, director of practical arts in the public schools of Kansas City, Mo., will conduct two lecture courses on industrial-arts subjects at the University of Minnesota during the summer of 1947.

♦ E. C. WAGGONER has been appointed director of the division of audio-visual aids in the department of public instruction, Springfield, Ill.

He obtained his education at Indiana Normal and Indiana University where he received his master's degree.

Following three years of teaching experience at Reddick, Ill., he joined the Elgin, Ill., high school faculty in 1920, and in 1928 became head of the science department. Mr. Waggoner is a pioneer in the utilization of audio and visual aids in the field of education. He was recommended by the National Education Association to direct the organization of audio-visual aids in test school districts in Texas in 1940.

He has served as a member of the Midwestern Forum of Visual Teaching Aids for the past eight years.

♦ JUDSON P. COLEMAN, director of mechanic arts and head of the printing department at Alabama A. & M. College, Normal, Ala., completed his work for the master's degree in vocational education at Wayne University, Detroit, during the past summer. The degree was conferred at Wayne's Midyear Commencement in January.

After receiving his B.S. degree in trade education at Hampton Institute, Va., Mr. Coleman worked with several printing and newspaper establishments before going to his present position seven years ago.

♦ GUSTAVE S. WALL, now in residence as a doctoral candidate at the University of Minnesota, has accepted a position in the Department of Industrial Education, University of Maryland. He will begin work there in the fall of 1947. Mr. Wall has had much experience in public schools and at Dunwoody Institute. His war service was in the navy, where he attained the rank of lieutenant commander.

♦ DR. HOMER J. SMITH, professor of industrial education, University of Minnesota, will spend the first three weeks of the summer of 1947 at the University of Kentucky. He will return to Minnesota for the second summer term.

Sheldon

VOCATIONAL EQUIPMENT

Shop Bench for Metal Working

SHELDON'S long, continuous, and successful experience; efficient planning service, and unsurpassed production facilities combine to provide the utmost in utility and economy in shop equipment. Let SHELDON'S Planning Department assist in preparing shop layouts, compiling budgets, and writing specifications.

SHELDON'S new catalog of equipment for Industrial Arts and Vocational Education is now on the press. Reserve your copy today.

E. H. SHELDON & COMPANY
MUSKEGON, MICHIGAN

♦ J. C. WOODIN, director of vocational and adult education, Wichita, Kans., has been appointed to serve on the editorial board of "Tech News," a new publication of the American Technical Society, Chicago, Ill.

♦ RAY KARNES, after serving three years with the army engineer's corps under GEN. MACARTHUR, has returned to his position at the University of Missouri.

♦ H. D. SHOTWELL, formerly instructor-coordinator of the office training program, Topeka, Kans., has been appointed state supervisor in the field of vocational business education, Topeka, Kans.

♦ LEO A. PEASLEE, who has eleven years of experience as an industrial machinist, has been appointed machine-shop instructor in the day trade program at Parsons, Kans.

♦ LOUIS P. HANCOCK has joined the teaching staff of the McFarland Trade School, Coffeyville, Kans. He will be instructor of auto mechanics.

♦ RAY EHLERT, who has ten years of experience as an industrial welder, has been appointed as welding instructor at the McFarland Trade School, Coffeyville, Kans.

♦ JOHN C. JUNKENS has been made welding instructor in the trade program at Kansas State Teachers College, Pittsburg, Kans. He has had eleven years of welding experience in industry and in the army.

♦ PERRY E. BABCOCK, assistant state supervisor of trade and industrial education of the eastern and southern sections of Georgia, has been made executive director of the entire vocational program of the city of Atlanta and Fulton County, GA.

♦ FRED S. JARVIS has been made instructor-co-

(Continued on page 58A)

STANLEY
TOOLS
STANLEY
Get your copy of
THE NEW STANLEY TOOL CATALOG No. 34
. . . tools for all school shops
FOR WOODWORKING AND FARM SHOPS The most complete line offered by one manufacturer.
FOR ELECTRICAL SHOPS Hammers, bit braces, bit extensions, screw drivers.
FOR SHEET METAL SHOPS Hammers, chisels, punches, etc.
FOR AUTOMOBILE SHOPS Hammers, chisels, punches, screw drivers, etc.
FOR MACHINE SHOPS Hammers, rules, chisels, punches, levels, etc.
FOR FORGE SHOPS Anvil tools, tongs, hammers, etc.
Visual teaching aids and project plans at cost.
STANLEY TOOLS
DIVISION OF THE STANLEY WORKS, Educational Dept., New Britain, Conn.
STANLEY
Trade Mark
HARDWARE · HAND TOOLS · ELECTRIC TOOLS

(Continued from page 54A)

c) Malleable-iron C, 4, 6, and 8 in.

DIVIDERS — wing, 6 in. and 10 in.

DOWEL PLATE — 6 in. long

DOWELING JIGS — with bushings

DRAWKNIVES — 7 in.

DRILL
- a) Automatic hand, with 8 drill points
- b) Chuck, 0 to 3/8 in.
- c) Hand, 0 to 3/8 in., for round-shank drills
- d) Star, for concrete, 1/2 in. and 3/4 in.

FILES
- a) Auger bit, assorted, 6 in.
- b) Cabinet, 8 in. and 10 in.
- c) Card and brush
- d) Flat, wood, 10 in.
- e) Mill, bastard cut, 12 in.
- f) Round, bastard cut, 12 in.
- g) Taper, slim, 5 1/2 in. and 7 in.

FIRST-AID CABINET AND SUPPLIES

GAUGES
- a) Bit, adjustable
- b) Jointer
- c) Marking, metal or hardwood
- d) Mortise, metal or hardwood
- e) Panel

GLASS CUTTER

GOUGES
- a) Tanged firmer, outside ground, handled, 1/8, 1/4, 1/2, 3/4, and 1 in.
- b) Tanged firmer, inside ground, handled, 1/8, 1/4, 1/2, 3/4, and 1 in.
- c) Spoon, 1/2, 3/4, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.

HATCHET — bench, 4-in. cut

JARS — earthenware, 1-qt. capacity

KNIVES
- a) Jointer, to fit power machine
- b) Planer, to fit power machine
- c) Sloyd, 3-in. blade

LEVELS
- a) Wood, 24 in.
- b) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head

NAIL SETS — 1/16 in. and 3/32 in. points

OILERS — bench, 1/3 pt., coppered, best grade

OILSTONES
- a) 1 by 2 by 8 in. in iron box
- b) Gouge slip, medium, 4 1/2 by 2 1/8 by 3/8 by 5/16 in.
- c) Gouge slip, fine, 3 by 2 by 3/8 by 3/8 in.

PINCERS — 6 in. carpenters'

PINCH DOGS — 3/4, 1, and 1 1/4 in.

PLANES
- a) Block, adjustable, 6 in. long, 1 5/8-in. cutter
- b) Circular
- c) Combination, adjustable
- d) Core box
- e) Duplex, fillister and rabbet
- f) Fore, 1/8 in., 2 3/8-in. cutter
- g) Irons, double
- h) Jack, 14 in., 2-in. cutter
- i) Jointer, 24 in.
- k) Round, wood, 1 3/4 in.
- l) Router
- m) Smooth, 9 in., 1 3/4 in. or 2-in. cutter

PLIERS
- a) Roundnose, 5 in.
- b) Side-cutting, 6 in.

PUTTY KNIVES

RASPS — half round, wood, 10 in.

RULES
- a) Board
- b) 1 ft. or 2 ft. graduated by 8ths and 16ths
- c) Shrink, 1/8 in., 3/16 in.

SAWS
- a) Back, 12 in., 14 point
- b) Band, to fit power machine
- c) Compass, 10 in.
- d) Coping, frames
- e) Coping, blades
- f) Crosscut, 9 tooth, 22 in. long
- g) Crosscut, circular for power machine
- h) Dado, 1/8 in. to 1 1/16 in. to fit power-saw arbor
- j) Hack, frames, 10 in. or adjustable
- k) Hack, blades, 10 in.
- l) Keyhole, 10 in., 10 point
- m) Rip, 7 point, 22 in. long
- n) Rip, circular for power machine
- o) Set, 10 points per inch and finer
- p) Set, 10 points per inch and coarser
- q) Turning frame, 14 in.
- r) Turning blades, 3/16 by 12 in., 10 tooth
- s) Miter box, 24 by 4 in. saw, 7-in. capacity at miter

SCRAPERS
- a) Cabinet
- b) Glue, triangular
- c) Veneer, blade, 2 3/4 in. long, handle 11 in. long

SCREW DRIVERS
- a) Cabinetmakers', 4, 6, and 8 in.
- b) Quick return, spiral ratchet

SHOOT BOARD — and plane

SNIPS — tinners', forged steel, 2 1/2-in. cut

SPOKESHAVES — adjustable, raised handle, 10 in. long

SQUARES
- a) Combination, 12 in.
- b) Try-, iron handle, 8 in.
- c) Framing, 2 ft.

STEEL FIGURES — hand cut, 1/8 in.

TAPELINE — 50 ft., steel

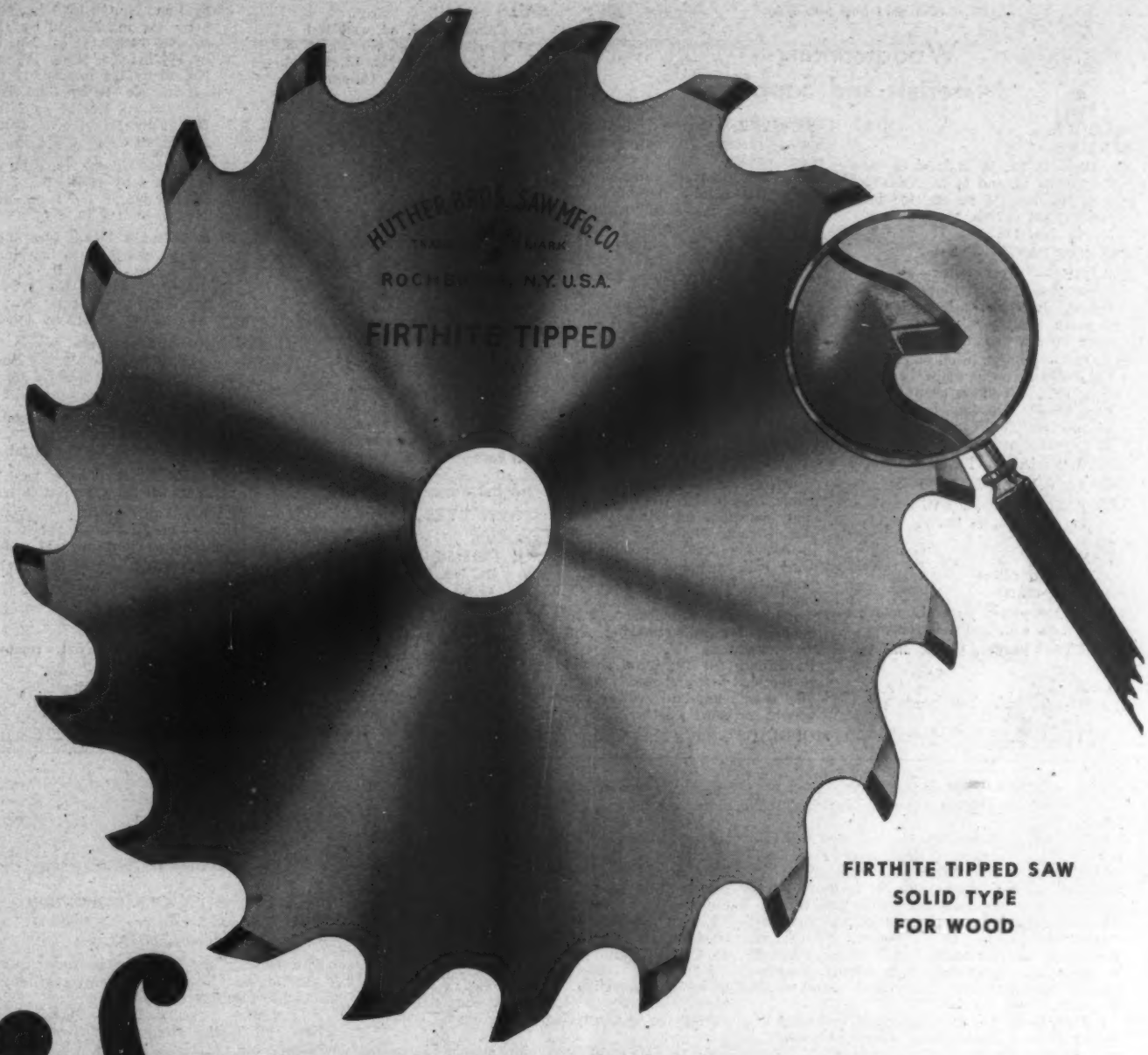
TRAMMEL POINTS — adjustable metal frame, steel points

TURNING TOOLS
- a) Calipers, 6 in. inside and outside
- b) Calipers, 12 in. inside and outside
- c) Parting tools, 1/8 in.
- d) Round point, 1/4 in., 1/2 in., 3/4 in.
- e) Spear point, 1/4 in., 1/2 in., 3/4 in.
- f) Square point, 1/4 in., 1/2 in., 3/4 in.
- g) Turning chisels, 1/4 in., 1/2 in., 3/4 in.
- h) Turning gouges, 1/4 in., 1/2 in., 3/4 in.
- j) Turning skews, L.H., 1/4 in., 1/2 in., 3/4 in.
- k) Turning skews, R.H., 1/4 in., 1/2 in.

VISE — 3-in. jaw, anvil face

WRENCHES
- a) Adjustable, 8, 10, and 12 in.
- b) Headless setscrew
- c) Pipe, 10 in. and 12 in.
- d) S type or open-end type to fit 1/8-in. to 1-in. N.C. nuts

(Continued on page 58A)



FIRTHITE TIPPED SAW
SOLID TYPE
FOR WOOD

if YOUR STUDENTS ARE TO TAKE THEIR PLACE IN THE TRADE–

They should have an opportunity to use or at least the experience of witnessing the performance of a HUTHER FIRTHITE TIPPED SAW, under the instructor's guiding hand. They cut with equal ease through hardwoods, teak, fire-proof lumber, hard masonite, plywood, linoleum and plastics, and stay sharp much longer. There is only a very slight reduction in diameter through sharpening FIRTHITE TIPPED blades. For other HUTHER products suitable for school shop use, send for our latest Catalog No. 60.

Write for HUTHER BROS. new specially prepared FIRTHITE FOLDER—just off the press!

HUTHER BROS.
SAW MFG. CO., INC.

1290 UNIVERSITY AVENUE, ROCHESTER, NEW YORK

Saw Makers for Over Sixty Years

(Continued from page 56A)

Woodworking— Materials and Supplies

ALCOHOL
BENZINE
BRADS — 3/8 in., 1/2 in., and 5/8 in. No. 20; 3/4 in. and 7/8 in. No. 19; 1 in. No. 18; 1 1/4 in. and 1 1/2 in. No. 16; 1 3/4 in. No. 15; 2 in. and 2 1/2 in. No. 14
CARBON PAPER — black
COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion
COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion
DECALCOMANIA TRANSFERS
DOWEL PINS AND PLATES
DOWELS: hardwood, 3-ft. lengths, 1/4 in., 5/16 in., 3/8 in., 1/2 in., 3/4 in.
ENAMEL
a) Selected colors
b) Undercoater
FILLERS — paste: natural, golden oak, dark oak, and mahogany
FILLETS — leather, 1/4 in. and 1/2 in.
GLUE
a) Casein, hide, best grade cabinet
b) Liquid
HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports
HOOKS
a) And eyes
b) Cup
c) Screw and
d) Square screw
LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow
LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine
In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking
Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths
MOLDINGS
NAILS
a) Common, 6d, 8d, and 10d
b) Flathead, 1/2 in. No. 20, 3/4 in. No. 19, 1 in. No. 18, 1 1/4 in. and 1 1/2 in. No. 16, and 2 in. No. 14
c) Finishing, 4d, 6d, and 8d
OIL
a) Linseed, boiled
b) Linseed, raw
c) Machine
d) Rubbing
OVERLAY CARVINGS
PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply
PATTERN LETTERS
PINS — escutcheon
PUMICE STONE — No. 0
RAPPING PLATES
ROTTENSTONE
SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, 1/2, 1
Garnet finishing paper, 6/0, 4/0
Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order
SCREW EYES
SCREWS
a) Flathead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 5 by 5/8 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in.
b) Flathead, bright, No. 3 by 1/2 in., No. 4 by 1/2 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1 1/4 in., No. 10 by 1 1/4 in., No. 14 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in., No. 10 by 1 3/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2 1/4 in. No. 14 by 2 1/4 in., No. 14 by 2 1/2 in.
c) Oval head, brass, No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., and No. 10 by 1 1/4 in.
d) Roundhead, blued, No. 3 by 3/8 in., No. 3 by 1/2 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No 10 by 1 1/2 in., No. 12 by 1 1/2 in
e) Roundhead, brass, No 3 by 3/8 in., No. 4 by 1/2 in., No. 4 by 5/8 in., No. 5 by 3/4 in.
SHELLAC
a) Orange, cut 4 lb. to the gal.
b) Sticks, assorted colors
c) White, cut 4 lb. to the gal.
NOTE: Shellac should be kept in glass or earthenware containers
STAINS — oil, spirit or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut
STEEL WOOL — No. 0 and No. 2/0
TURPENTINE
TWINE
VARNISH — coach, flat, remover, spar, and rubbing
WASTE — cotton, white
WAX — bees and finishing
WHITE LEAD

(Continued from page 55A)

ordinator of distributive education at Pittsburg, Kans.

♦ WALTER J. ELDER has joined the staff of Kansas State Teachers College, Emporia, Kans., as teacher-trainer for distributive education. He was formerly teacher-co-ordinator of distributive occupations at Appleton and Sheboygan, Wis.

♦ F. LESTER TRAFTON, newly elected superintendent of schools in Claremont, N. H., in addressing the Claremont Rotary Club, outlined to them the vocational trade school program offered in Claremont and other districts in the state.

♦ PAUL MORE has been appointed instructor of industrial arts and evening school co-ordinator at Kingsport, Tenn.

♦ K. OTTO LOGAN has been appointed assistant supervisor of distributive education for the state of Washington.

♦ WALTER BROWN has joined the trade and industrial education division of the state vocational department in Missouri.

♦ DR. LYMAN E. JACKSON has been appointed dean of the school of agriculture at Pennsylvania State College, State College, Pa. He replaces Dean S. W. Fletcher, retired.

♦ ALBERT F. GUITERAS of Foster D. Snell, Inc., 305 Washington St., Brooklyn 1, N. Y., has been elected president of the New York professional chapter of Alpha Chi Sigma.

♦ FOSTER DEE SNELL, president of Foster D. Snell, Inc., 305 Washington St., Brooklyn 1, N. Y., has been elected an honorary member of the Chemical, Metallurgical and Mining Society of South Africa. He is also president of the American Institute of Chemists.

♦ DR. CORNELIA T. SNELL of Foster D. Snell, Inc., 305 Washington St., Brooklyn 1, N. Y., spoke at a vocational conference for women students at Purdue University held recently. In her talk on "Women as Professional Chemists," the opportunities of women were discussed in detail from the practical point of view.

♦ PEARL E. OLDT, teacher of printing at Central High School, Grand Rapids, Mich., was elected secretary of the International Association of Printing House Craftsmen at their annual convention held in September, 1946, at Montreal, Canada.

♦ WILLIAM R. MITCHELL has been appointed teacher of printing at the Technical High School, St. Cloud, Minn.

♦ HARRY F. AINSWORTH, state supervisor of vocational education, Indiana, died suddenly in November. He was noted as an aggressive leader during the war years and the postwar reconversion period.

♦ I. C. HUMBERT has been appointed teacher of mechanical drawing at Central High School, Cleveland, Ohio.

♦ JOHN SHEELER teaches printing at Central High School, Cleveland, Ohio.

♦ M. F. MOSES was transferred from Empire Junior High School to teach drawing at the Collinswood High School, Cleveland, Ohio.

♦ GEORGE FEHLNER has been appointed instructor of auto mechanics at Collinwood High School, Cleveland, Ohio.

♦ MERLE UNKEFER is teaching foundry work at the Collinwood High School, Cleveland, Ohio.

♦ TED HARTMAN is teaching veterans' mechanical drafting classes at East Technical High School, Cleveland. Ohio.

♦ CLARENCE DOUBLER has been appointed instructor of printing at the East Technical High School, Cleveland, Ohio.

♦ RAY YECH was transferred to the Glenville High School, Cleveland, Ohio. He has charge of a general shop in which metalwork, woodwork, and plastics are taught.

♦ BERNARD SPECHT is teacher of mechanical drawing and art at the East Technical High School, Cleveland, Ohio.

Association News

REPORT OF THE A.V.A. CONVENTION

(Continued from page 26A of the February, 1947, issue)

The theme of the Thursday afternoon meeting of the Industrial Education section was "Industrial Education From Now On."

F. J. Jeffrey, principal, Hadley Technical High School, St. Louis, Mo., was chairman of the meeting.

J. C. Woodin, director of industrial education, Wichita, Kans., chose "Determining the Place of Industrial Education in a City School Program" as the title of his address.

Harry J. Hagen, first vice-president, Lathers International Union, St. Louis, Mo., spoke on "What Labor Expects of Trade and Industrial Education From Now On"; and Fred Karches, director of operations, Rice-Stix Company, St. Louis, Mo., discussed "What Industry Expects From Trade and Industrial Education From Now On."

Joseph R. Strobel, state director of vocational education, Columbus, Ohio, presented the topic, "Vocational Education From Now On."

The discussion was lead by O. D. Adams, assistant superintendent of schools, San Francisco, Calif.

Other meetings were held on supervisory training, co-operative occupational training programs, American association of technical high school and institutes, printing education, building trades, and automotive trades.

The vocational guidance section meetings were

(Continued on page 60A)

Hollow Chisel Mortiser

"OLIVER"
WOODWORKING MACHINERY

Junior Model Oilstone Tool Grinder

Students trained on "Oliver" machines accomplish more

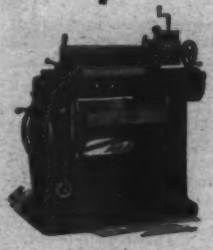
Students trained on "Oliver" machines enter industry with a sound training for further progress, reflecting credit on your instruction.

Safety is a keynote of "Oliver" design. As for performance, "Oliver" machines have those *plus* features that make them the choice of industry the world over. They are engineered to stand up under hard usage for years and years. Moreover, students are soon able to set up "Oliver" machines accurately. Self-locking devices keep machines in perfect adjustment.

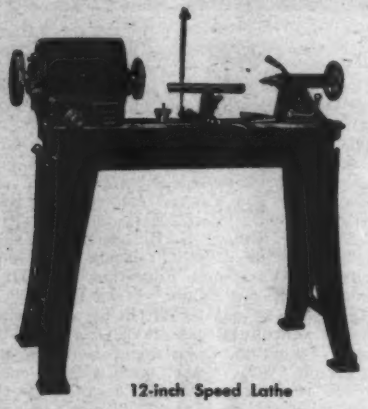
Is your shop equipped to meet the increased demands of today? Now is the time to check it. The machines illustrated are typical of a complete line of Circular Saw Benches, Band Saws, Jig Saws, Planers, Jointers, Shapers, Speed Lathes, Tool Grinders and other equipment to make your teaching most effective.

Disk Sander

Double Arbor, Motor Arbor, Tilting Saw Bench



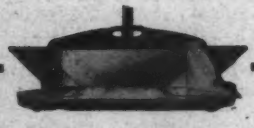
24-inch Surface Planer



12-inch Speed Lathe

30-inch Band Saw

8-inch Hand Planer and Jointer



Wood Trimmer

Tilting Arbor Variety Saw Bench

Over 2100 schools shops use "Oliver" equipment. If you'll tell us the machines that interest you, we shall send you illustrated bulletins containing full details.

OLIVER MACHINERY COMPANY, GRAND RAPIDS 2, MICHIGAN

Two Books JUST OFF PRESS!

YOUR CRAFT BOOK

by Newkirk and Zutter — $4.00 *(School Edition)*

Here is a book of intriguing projects, 108 in all, for elementary schools, grades one to eight. It is full of ideas for gifts, play and decoration and provides many fine examples of art principles as applied to construction work. There are 20 vari-colored plates, plus 88 in black and white. 224 pages.

THE PRODUCTION AND PROPERTIES OF PLASTICS

by Kaye — $4.00 *(Educational Edition)*

Of interest to schools and persons desiring up-to-date technical information, this book provides a complete survey of the development, chemistry, properties, testing, design and production of plastics. A thorough analysis of the subject is augmented by the practical shop experiences of the author. 602 pages, 230 illustrations.

Other Outstanding Shop Books for Your Classroom:

INDUSTRIAL ARTS

HOUSEHOLD MECHANICS $2.40
Bedell and Gardner
WOODWORKING FOR EVERYONE 2.40
Shea and Wenger
PLASTICS — PROBLEMS AND PROCESSES 3.00
Mansperger and Pepper
ELEMENTARY MECHANICAL DRAWING 1.60
Kleuke and Hayes
ADVANCED MECHANICAL DRAWING 1.75
Kleuke and Hayes
ENGINEERING DRAWING 3.50
Carter and Thompson
EXPLORING THE GRAPHIC ARTS 3.00
Mariuccio and Osburn
PROGRESSIVE LESSONS IN PRINTING 1.50
Bohrer
EXPLORING THE ARTS AND INDUSTRIES 2.00
Williams
PEWTER — SPUN, WROUGHT AND CAST 2.50
Osburn and Wilber
THE STUDENT'S PLANNING BOOK ..... .40
Baysinger and Silvius

BUILDING TRADES

CARPENTRY I, Volume 250C $2.45
Lowndes
CARPENTRY II, Volume 251C 1.75
Lowndes
CARPENTRY III, Volume 252C 2.65
Lowndes
BUILDERS HARDWARE, Volume 266C 1.30
I.C.S. Staff
THE STEEL SQUARE, Volume 254 ..... 1.50
I.C.S. Staff
PLASTERING AND ARCHITECTURAL TERRA COTTA, Volume 246C — *Lowndes* 2.00
BUILDING STONE FOUNDATIONS — MASONRY, Volume 245B — *Lowndes* 1.80
PLAIN AND FANCY BRICKWORK, Volume 248B 1.60
Lowndes
PAINTING AND WOOD FINISHING, Volume 253 ..... 1.00
Lowndes
THE SLIDE RULE, Volume N255 ..... 1.00
Strohm and I.C.S. Staff
BUILDING TRADES HANDBOOK 1.00
I.C.S. Staff

Examination copies will be sent on approval. If you are in the educational field you are entitled to the usual discount.

INTERNATIONAL TEXTBOOK COMPANY Scranton 9, Pennsylvania

(Continued from page 58A)

held on Wednesday afternoon, Thursday morning, Thursday afternoon, and Friday morning.

At the Thursday morning session, M. D. Mobley, A.V.A. past-president representing vocational guidance, and state director of vocational education, Atlanta, Ga., was chairman; and Glenn E. Smith, state supervisor, occupational information and guidance services, Jefferson City, Mo., presided.

Dolph Camp, state supervisor of occupational information and guidance services, Little Rock, Ark., explained "Probable Trends in Federally-Aided Programs of Vocational Guidance."

Then M. Norcross Stratton, state director of vocational education, Boston, Mass., presented the topic, "Guidance Services Needed in Programs of Vocational Education," which was discussed by a panel consisting of Earl H. Little, John Coleman, Ruth Huey, J. M. Wommack, J. Warren Smith, John H. Hughes, Marlin C. Schrader, Ella Stephens, Martha Creighton, Mark Nichols, Frank Johnson, and David L. Nicholson.

At the Thursday afternoon session Rufus M. Pulliam, state supervisor of occupational information and guidance services, Atlanta, Ga., presided.

Carl M. Horn, chief, occupational information and guidance services, State Board of Control for Vocational Education, Lansing, Mich., chose for his topic, "Co-ordinating and Utilizing Community Resources in Job-Placement Services."

Charles W. Sylvester, director of vocational education, Baltimore, Md., then spoke on "The Place and Importance of Follow-up Studies in Secondary Schools."

The Friday morning session was presided over by Carl M. Horn. A panel consisting of Dolph Camp, S. C. Hulslander, Paul C. Polmantier, H. H. London, Eleanor M. Zeis, Homer J. Smith, Ralph Woods, John T. Wheeler, Anthony Goldberger, and George L. Blackwell discussed "Potential Developments in Counselor Training Under the Stimulation of the George-Barden Act."

The part-time education section held its meetings Wednesday afternoon and Thursday afternoon.

The first of these was presided over by Grace M. Henderson, A.V.A. vice-president for part-time schools; Pennsylvania State College, State College, Pa.; and a panel consisting of R. L. Welch, Clinton A. Reed, Mary S. Lyle, Charles W. Sylvester, Russell B. Dickerson, and Claud M. Andrews discussed "Problems and Opportunities in Vocational Education for Out-of-School Youth and Adults."

At the second meeting W. F. Stewart, department of agricultural education, Ohio State University, Columbus, Ohio, presided over a symposium on "What Communities Have Done to Provide Effective Vocational Education for Out-of-School Youth and Adults." This was presented by Cola D. Watson, W. N. Elam, A. W. Woods, Dora Mollenhoff, W. R. Cate, Jr., Ralph E. Bender, C. A. Nolan, and Carl W. Brown.

The vocational rehabilitation section held its meeting Thursday afternoon under the chairmanship of Clare D. Rejahl, district supervisor of vocational rehabilitation, State Board of Vocational and Adult Education, Madison, Wis.

Anthony K. Busch, assistant superintendent and clinical director, St. Louis City Sanitorium, St. Louis, Mo., addressed the meeting on the theme of "Rehabilitation and Its Relation to the Mentally Disabled."

At the House of Delegates meeting Friday afternoon the following resolutions were adopted:

1. Your Resolutions Committee of December, 1946, adopted the form of presentation of the Resolutions Committees of February, 1946, and of December, 1944, which committees presented a series of statements of basic policy that essentially constituted a platform for Vocational Education in the United States.

2. The American Vocational Association reaffirms its strong belief that it is a part of our fundamental philosophy of Vocational Education that economic independence for the individual is a vital cornerstone of the democratic way of life; and that such education be an integral part of all educational programs and therefore should include education for the understanding of the social, economic, and aesthetic environment as well as for work. This assumes education for complete living and affects all levels of schooling.

It is recommended therefore that, irrespective of economic status and life goals, instruction and guidance should be under properly qualified instructors, housed in standard school buildings equipped with adequate facilities and provided with appropriate supplies.

It is further recommended that the United States Office of Education make a study of substandard school situations throughout the nation and render assistance by counsel and any other such aid permitted within the scope of that Office.

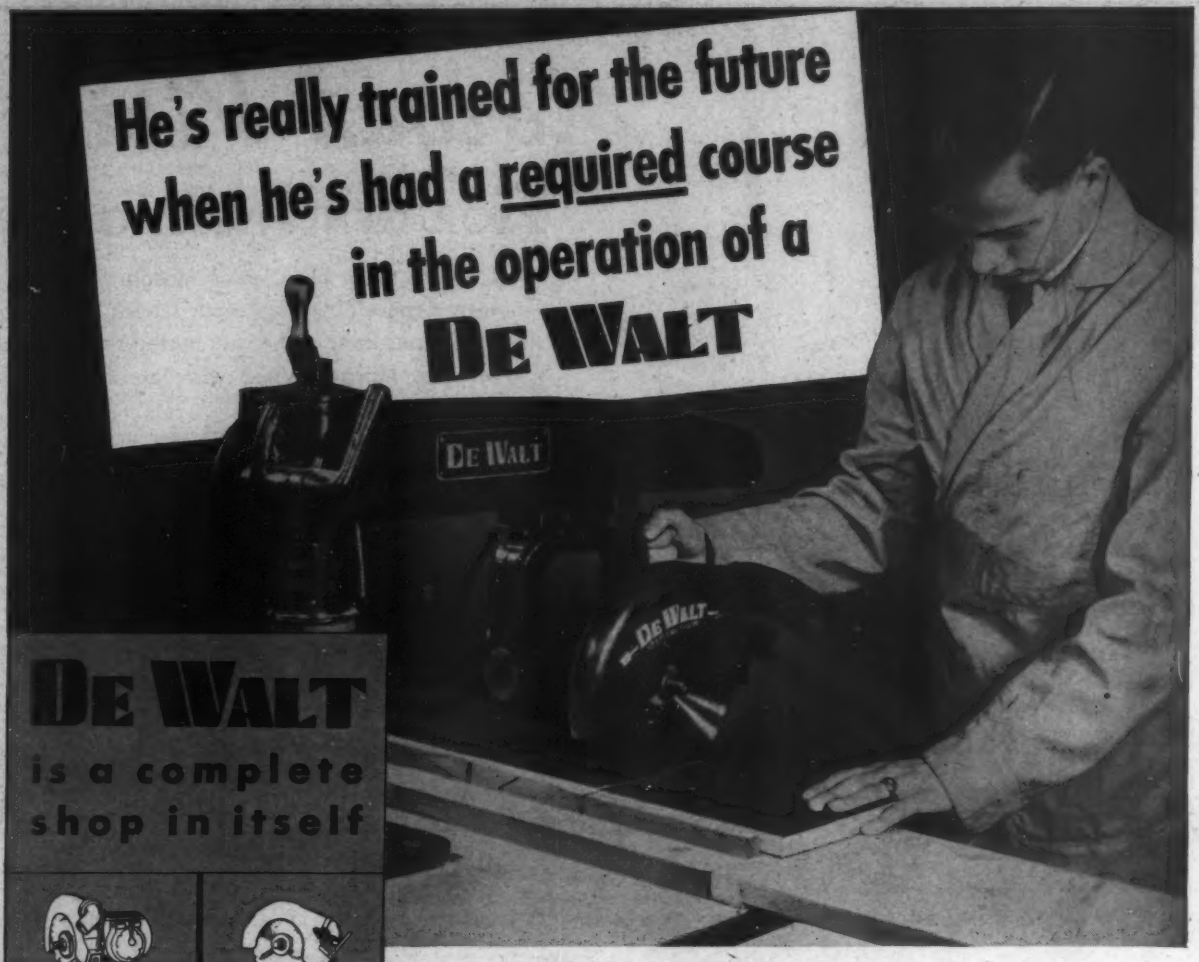
3. The passage of the George-Barden Act is another notable achievement furthering the services of Vocational Education in the several states and territories. All persons interested in the education of American youth, and the American Vocational Association, in particular, recognize this act as ranking in importance with the Smith-Hughes Law and the several related laws; and further, that the action by Congress in passing the George-Barden Act, almost unanimously, expresses the faith of the American people in the services of Vocational Education in War and in Peace.

We wish to express our grateful appreciation to the members of the National Congress for passing the George-Barden Act, which provides the largest authorization for federal funds to states for Vocational Education that has ever been approved in a single measure.

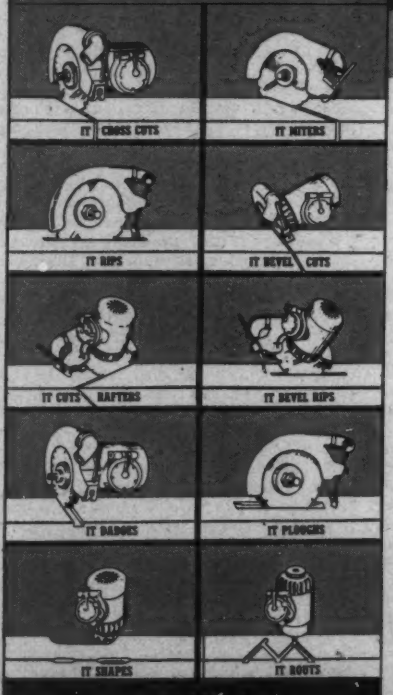
Our thanks are also extended to President Truman for his approval of the measure which made it law.

(Continued on page 62A)

He's really trained for the future when he's had a required course in the operation of a DE WALT



DE WALT is a complete shop in itself



...and with proper tools makes any cut possible!

After the student has completed his basic training course in the use of hand tools, he should have a required course in the operation of DeWalt.

Knowing how to make the fullest use of this flexible, easy-to-operate machine, will give any student a head-start as he prepares for tomorrow's industry.

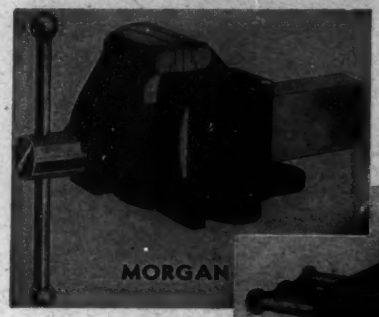
When he leaves school he will be fully acquainted with a machine that is destined to occupy a prominent place in tomorrow's industry. The perfection of the DeWalt saw has created new methods in cutting wood, making obsolete old-style equipment previously used.

If you are planning new equipment for your training school, don't take a chance on getting a DeWalt from the War Assets Administration — very few are available. Include DeWalt in your budget, and put in your order direct.

Ask a nearby DeWalt dealer about two DeWalt 16MM movies—one showing the general application of DeWalt—the other showing modern, pre-cutting techniques developed during the war. Write for catalog.

DEWALT PRODUCTS CORPORATION

123 Fountain Avenue **Lancaster, Penna.**

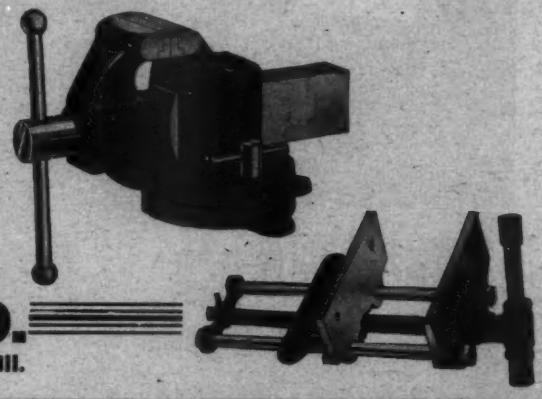


Continuous Screw Vises can be supplied with steel handles at small additional cost.

Morgan Vises

FOR GENERAL SHOP USE

For more than thirty years Morgan Vises have given dependable service to school and industrial shops. Built of the best materials and workmanship, Morgan Vises will "do their bit" in your shops.



Perform a service to your school and give your students a real vise to work with. Specify MORGAN when you equip your shop, and get the best at no extra cost.

Morgan vises can be had in various sizes and styles to meet every purpose. Write for literature and prices.

MORGAN VISE CO.

120 N. Jefferson St. Chicago 6, Ill.

(Continued from page 60A)

Though we are grateful to all these members of Congress who supported the measure, we especially desire to identify for special commendation Senator Walter F. George, of Georgia, for his leadership in getting this Vocational Education Act, which bears his name, passed unanimously by the Senate; Congressman Graham A. Barden of North Carolina, for his skill in guiding the measure through the House Education Committee (of which he is chairman) and on the floor of the House; and Congressman John S. Wood, of Georgia, for flying to Washington to help break an apparent stalemate and get the measure approved by the House Education Committee.

We also wish to express appreciation to all those who testified for the bill before the Senate Education and Labor Committee and the House Education Committee as well as hundreds of others who assisted in many ways in obtaining favorable action on the measure.

Members of the American Vocational Association are indeed indebted to our efficient Executive Secretary, L. H. Dennis, President, C. S. Greiber, Past-President, M. D. Mobley, and others for the many hours, days, and weeks they so skillfully devoted to securing favorable action on the George-Barden measure.

4. The passage of the George-Barden Act calls for continuance of a vigorous, aggressive and virile national, state, and local leadership which has characterized the Vocational Education movement. The successful implementation of this Act will fall in large measure upon the states and local communities. Inasmuch as state and local needs vary throughout the nation, and in order that there may be thorough understanding of the conditions of implementation, it is strongly recommended that local administrators be invited to participate in making plans under which the provisions of this Act can be carried out.

5. The American Vocational Association has long recognized the importance of Vocational Guidance to the development of Vocational Education, and has sought means for making it more effective.

The Congress, responding to the request of the Association for specific recognition of Vocational Guidance and Vocational Counseling as contributing factors to the success of Vocational Education has, through the George-Barden Act, made special provision for Vocational Guidance and Vocational Counseling in the program of Vocational Education. We recommend, therefore, that the American Vocational Association urge state and local Vocational Education authorities to study the needs in the area of Vocational Guidance, and further urge each state to utilize the provisions of the George-Barden Act in accordance with their needs, resources, and objectives, in developing sound local programs of Vocational Guidance and Vocational Counseling, based on adequate provisions for supervision, counselor training, and research.

6. It is recognized that a great need exists in effective guidance and training of the physically handicapped at all educational levels to the end that the handicapped may find normal places in our social and economic life. Some states are establishing separate boards or agencies outside of public education for controlling and carrying on programs of guidance and training for physically handicapped persons. We believe this is not conducive to meeting the needs of these deserving people and urge that all such guidance and training be carried on by agencies under public supervision and control. It is further believed that the interests of the physically handicapped can best be served by providing training opportunities in normal school situations.

7. The American Vocational Association reaffirms its recognition of its obligations to the men and women who sacrificed so much, and through their victories on the battle fronts of the world, brought great honor to our country and to us.

The Congress through legislation has recognized the debt of the people to these young veterans. The program of education and training under this legislation is now in operation. A committee of the American Vocational Association appointed in Buffalo has rendered valuable service to the veterans, to education, and to the Veterans Administration in relation to the solution of problems arising in the education of veterans. It is desired that this committee be continued.

There are further problems in veterans education and training, at state and local levels such as the clarification of responsibilities in on-the-job training, the development of related training programs, subsistance for trainees, and the supervision of on-the-job training. These problems continue to be with us and it is the desire of the American Vocational Association, therefore, that its Special Veterans Education Committee consult with the Veterans Administration to the end that adequate solutions be determined and implemented.

8. The American Vocational Association is deeply indebted to all persons and groups responsible for its various publications during the past year, especial recognition is given the consulting editors, for their time and industry in securing and preparing materials, and the editorial staffs for their preparation of outstanding publications in the field of Vocational Education and Industrial Arts.

9. The American Vocational Association strongly subscribes to the efforts of the National Education Association and the American press for their program of publicity to secure equitable salary adjustments commensurate with the preparation required and the services rendered by the teachers of the Nation.

10. It is significant that the American Council of Local Administrators has gone on record in

(Continued on next page)

(Continued from previous page)

support of the continuing and growing interest in industrial arts as an area of education that should have close correlation with Trade and Industrial Education as well as being a function of General Education.

11. The American Vocational Association expresses its appreciation to the State Committee in Missouri, and their friends in Illinois, the St. Louis Convention Bureau, and the Headquarters Hotels for the excellent accommodations and entertainment provided for this convention.

We are truly appreciative of the efforts of President Greiber, Secretary Dennis, and other members of the A.V.A. Executive Committee and the various program chairmen in making the sessions of this convention interesting and profitable.

12. We are especially grateful to the Vocational Education staff of the United States Office of Education for their valued contributions to the many programs of this convention.

We commend the speakers and other participants in the various programs for their fine contributions.

The resolutions committee consisted of the following: Verne C. Fryklund, chairman; Leona C. Buchwald, Maryland; R. E. Cammack, Alabama; O. H. Day, Missouri; Millie V. Pearson, Oklahoma; John M. Lowe, West Virginia; C. H. Warren, North Carolina; and Donovan R. Armstrong, Louisana.

The officers elected for the ensuing year are: president, Miss Florence Fallgatter, head of the department of home economics at Iowa State College, Ames, Iowa; vice-president in charge of industrial education, E. L. Williams of College Station, Tex., head of the department of industrial education at Texas A. and M. College; vice-president for vocational rehabilitation, J. J. Brown of Austin, Tex., staff member of the Texas Vocational Rehabilitation Department; treasurer, Charles W. Sylvester, director of vocational education at Baltimore, Md.

The Ship's program was staged on Friday at 8:00 p.m. A. L. Opie, The O-P Craft Company, Inc., Sandusky, Ohio, was captain and Todd Jones, School Shop, Ann Arbor, Mich., was deck officer.

The Ship Award was presented to John A. McCarthy, state director of vocational education for New Jersey. It reads as follows:

"John A. McCarthy, distinguished son of New Jersey; In recognition of your outstanding national leadership in the field of Industrial Education, we of The Ship salute you. Your enduring faith in the youth of America, as exemplified in your life, consecrated to the great profession of teaching, your educational contributions as a lecturer, consultant, and teacher, supplemented by your readiness to serve, your proven devotion to the fundamental educational philosophy of learning through creative effort, all these combined with a sympathetic understanding of human values in our American industrial way of life, have enabled you to give to America that educational leadership that has made and will continue to make America the land of opportunity.

"John A. McCarthy, assistant commissioner of schools in charge of vocational education, state of New Jersey, your clear vision, sterling honesty and outstanding educational philosophy have enabled you to serve and guide our youth in the ideals of democracy, that America may continue to be a nation of free men. The American industry, through its educational representatives, The Ship's Crew, has been ever mindful and appreciative of your untiring interest and co-operation that is bringing closer together the educational and industrial interests of American democracy.

"John A. McCarthy, we of The Ship are honored by this privilege to pay tribute to you and your constructive leadership in American Education. Again we salute you, as we wish you many more years in which to carry on American industrial education to even greater heights of achievement."

The next annual meeting will be held at Los Angeles, Calif.

First row, left to right: Dr. Grace M. Henderson, vice-president; Charles W. Sylvester, treasurer; Miss Florence Fallgatter, president; C. L. Greiber, past-president; Dr. Anna K. Banks, vice-president.

Second row: H. C. Fetterolf, vice-president; L. H. Dennis, executive secretary; Dr. Ira W. Kibby, vice-president; E. L. Williams, vice-president; Frank C. Moore, vice-president.

♦ The 36th annual convention of the Eastern Arts Association will meet in Philadelphia at the Benjamin Franklin Hotel, April 10, 11, and 12, 1947.

♦ Eta Chapter of the Epsilon Pi Tau Fraternity held its annual initiation banquet at State Teachers College, Peru, Neb., on January 9, 1947. Three new members were initiated. Frank L. Sievers, state supervisor of occupational information and guidance, spoke on "What Can the Industrial Arts Program of Schools Contribute to Guidance?"

♦ The Texas Vocational Association will hold its annual convention on April 3, 4, and 5, 1947, at Forth Worth, Tex. The headquarters will be located at the Hotel Texas.

♦ National officers of Iota Lambda Sigma, professional fraternity in industrial education, were elected at the annual meeting in St. Louis, Mo., December 6. Charles P. Parsons, Chattanooga, Tenn., was elected president; B. R. Turner of Columbia, S. C., vice-president; Clyde H. Wilson of Knoxville, Tenn., secretary-treasurer; and George H. Resides of State College, Pa., historian. Resides retired from the office of secretary-treasurer after twenty years of service and was presented an appropriate gift.

S. Lewis Land of Pennsylvania State College presided over the sessions, and the principal address was made by Layton S. Hawkins, chief, trade and industrial education service of the U. S. Office of Education. R. W. Gregory, assistant commissioner for Vocational Education of the U. S. Office, was presented an honorary membership and spoke briefly. The fraternity now numbers 16 chapters in leading colleges and universities, and granted a charter for a new chapter at the University of Cincinnati.

♦ A committee for the revision of industrial arts in Fulton County, Atlanta, Ga., is composed of the following members: Wm. Bryce, North Fulton School, subject — woodwork; E. H. Moldenhauer, Fulton School, subject — mechanical drawing; C. Arnston, Russell School, subject — metalwork; and A. M. Reinhold, West Fulton School, subject — electricity.

Further meetings each month are set up until the entire program will have been revised.

♦ The American Industrial Arts Association will meet with the Ohio Industrial Arts Association in Columbus on April 24 to 26 in what should prove to be a notable postwar series of conferences and exhibits. The Neil House has been chosen as the headquarters.

♦ The Twenty-Fifth Meeting of the National Council of Teachers of Mathematics will be held in Atlantic City, New Jersey, Chalfonte-Haddon Hall, February 28, and March 1, 1947.

Speakers for February 28 will include the following outstanding leaders in the field of mathematics education: M. L. Harting, University High School, Chicago, Ill.; Raleigh Schorling, University High School, Ann Arbor, Mich.; W. Brownell, Duke University, Durham, N. C.; H. G. Wheat, West Virginia University, Morgantown, W. Va.; Robert L. Morton, Ohio State University, Athens, Ohio; E. H. C. Hildebrandt, Northwestern University, Evanston, Ill.; Lucien B. Kinney, Stanford University, Stanford, Calif.

The discussions by these speakers cover a wide range of topics to meet the interests of elementary school, high school, and junior college mathematics teachers. A few of these topics are: "Teaching Methods of Studying Arithmetic," "Remedial Arithmetic Project in New York City," "A Classroom Teacher Looks at Textbooks," "Recruiting and the Economic Status of the Mathematics Teachers," and "Consumer Mathematics in the Twelfth Grade."

On Saturday, March 1, the following speakers will appear on the program: Harold P. Fawcett, Ohio State University, Columbus, Ohio; Margaret Nagood, Bureau of Agricultural-Economics, Washington, D. C.; Mary A. Potter, Mathematics Specialist in the City Schools, Racine, Wis.; Ruth G. Sumner, Oakland, Calif.; H. V. Baravalle, Adelphi College, Garden City, N. Y.; Walter H. Carnahan, Purdue University, Lafayette, Ind.; Dennis H. Cooke, East Carolina Teachers College, Greenville, N. C.; C. V. Newsom, Oberlin College, Oberlin, Ohio.

The topics of these speakers vary from "Dynamic Beauty in Geometry" to "A Usable Philosophy in Teaching Arithmetic," and "Measurement of Understanding in Elementary School Mathematics" to "The Abacometer."

New + Practical
Van Nostrand
Textbooks

ELEMENTARY RADIO SERVICING
WELLMAN

This very new book (February, 1947) covers all types of radio service. It is especially prepared for vocational school students. Steps are described in a how-to-do-it manner, and the related theory is intelligently simplified. No mathematics are used. Major topics are followed by Job Sheets which list concisely the aim, theory, and procedure involved. Summary questions and reference lists appear at the end of each chapter. A wealth of diagrams illustrates the text. $3.00

SELECTED CHECK LIST

Elements of Automotive Mechanics—Heitner, Shidle, and Bissell $2.80
Machine Shop Theory and Practice—Wagener and Arthur 2.80
Arc Welding—Sacks 3.20
Industrial Electricity—Nadon and Gelmine 3.60
Elementary Radio Servicing—Wellman 3.00
Elements of Radio—Hellman 2.40
Television Simplified—Kiver 4.75
General Metal Work—Grayshon 2.60
Mathematics of the Shops—McMackin and Shaver 2.52
Applied Mechanical Drawing—Paull and Sgro 2.00
Mechanical Drawing—Nicholson 2.00
Freehand Drafting—Zipprich 1.80
Plastics in School and Home Work-Shop—Lockrey 2.75
Home Mechanic's Handbook (6 vols.) Text Edition each 1.28
Home Freezer Handbook—Stout 3.95
Managing a Farm—Johnson et al .. 2.95
Dwelling House Construction—Dietz 4.50

Any of these books may be examined without charge, on our 30-day approval plan. Send for new catalog.

D. VAN NOSTRAND COMPANY, INC.
250 FOURTH AVENUE, NEW YORK 3

Shop Equipment News

NEW PRODUCTS — PUBLICATIONS

SOUTH BEND BRASS COLLETS

A new line of precision draw-in collets made of brass has been announced by the South Bend Lathe Works. Although not intended to replace the more expensive hardened steel collets, they are manufactured to the same exacting tolerances. Their low cost makes them especially desirable for odd sizes that are used only occasionally. When worn, a brass collet can be rebored to a larger diameter. They can also be machined for holding tapers or irregular shapes.

Brass collets

The brass collets are made in standard fractional sizes, 1/16-in. capacity up to the maximum capacity of the collet in increments of 1/64 in. They are also available with decimal hole sizes for any diameter between .0625 in. and the maximum capacity of the collet. Collets with metric hole sizes are supplied in increments of ½ mm., any size between 1.5 mm. and the maximum metric collet capacity.

For more complete information and specifications, ask for Bulletin No. 83 from the South Bend Lathe Works, 178 E. Madison St., South Bend 22, Ind.

For brief reference use IAVE—0301.

NEW VICTOR SOUND-MOTION PROJECTOR

Improvements in design, performance, and economy have been embodied in the new 16mm. Victor Model *60* sound-motion picture projectors just announced by the Victor Animatograph Corporation, Davenport, Iowa.

New sound-motion projector

The new projector is housed in a streamlined, aluminum case, and contains many mechanical improvements. It is a multiple-purpose unit for use with either sound or silent film and includes jacks for use with a record player or as a public-address system. It includes reverse operation and has the advantage of still picture projection.

Among the many new features is the Instantilt—a device which centers the picture on the screen at the touch of a finger; also, the new Duotrol which provides separate controls for both bass and treble tones so that the full harmonic value of sound may be transmitted.

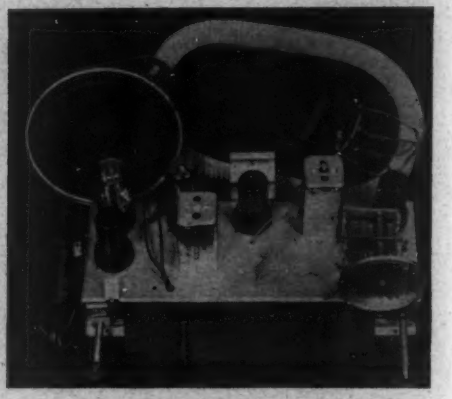
The new Clutch-Controlled Rewind permits fast, safe, convenient rewinding of film without shifting belts or reels. Then there is a new leveling device which compensates for uneven projection surfaces.

Model *60* is compact and portable and accommodates 2000-foot reels.

For brief reference use IAVE—0302.

RADIO RECEIVER KITS

Radio receiver construction kits for radio education applications in schools and colleges have been made available by the specialty division of General Electric Company's electronics department.



General Electric receiver kit

Designed to illustrate all the principles involved in modern radio-receiver construction, the new kits are similar to the type used extensively in the radio and electronic training courses conducted during the war by the army and navy.

The radio kits include all the parts necessary to build a complete 5-tube superheterodyne receiver, a punched chassis, tubes, loop antenna, 5-in. loudspeaker, and specially written instructions and diagrams. Students may perform many instructive experiments, and study rectifiers, filters, amplifiers, oscillators, etc., with these kits.

Further information on the newly available radio receiver construction kits may be obtained by writing the educational section, G-E Electronics Department, Wolf Street Plant, Syracuse, N. Y.

For brief reference use IAVE—0303.

NEW TRAINING FILMS

A new series of industrial-training films, to assist in teaching the operation and safe practices on the engine lathe, have just been released by the Jam Handy Organization.

The material pictured in each film is divided into several lessons, each with review questions to serve as a guide for group discussion. Subjects: (1) kinds, parts, safety; (2) operating, speeds; (3) carriage controls, feeds; (4) turning tools; (5) chucks, chucking work; (6) centers, setting tools, facing; (7) center holes, mounting work, facing between centers; (8) turning between centers, shouldering; (9) recessing, chamfering, filing, polishing, knurling; (10) angular turning, taper turning with a compound rest; (11) collets, faceplates, rests.

These films are produced and distributed by the Jam Handy Organization, 2831 E. Grand Blvd., Detroit, Mich.

For brief reference use IAVE—0304.

NEW BLACKHAWK PORTO-POWER CATALOG

The new Blackhawk Porto-Power Catalog is

(Continued on page 66A)

ATKINS *Silver Steel* SAWS

AS BASIC AS BOOKS

Good tools like Atkins "Silver Steel" Saws are as important to your school work-shop as good textbooks to other classrooms. They speed successful teaching because they make learning easier—by quickly overcoming the beginner's hesitancy—by helping him achieve early results that promote interest in doing better. They accomplish these results because they are the result of years of saw specialization . . . of producing blades that cut faster, cleaner, easier . . . of developing keener, tougher teeth that keep cutting longer. And Atkins Blades are budget-sparing, too — built to stand the knocks of day-in and day-out school-shop service.

E. C. ATKINS AND COMPANY
Home Office and Factory: 402 S. Illinois St., Indianapolis 9, Ind.
Branch Factory: Portland, Oregon
Branch Offices: Atlanta • Chicago • New Orleans
New York • San Francisco

ATKINS

And now
NEW MICROMETER ADJUSTMENT BASE

. . . for Stanley-Carter Routers

WITH this new Carter Base a single knob lets you lock, unlock, set or *slide the motor out.* Now you can make micro settings for different depth cuts faster and easier.

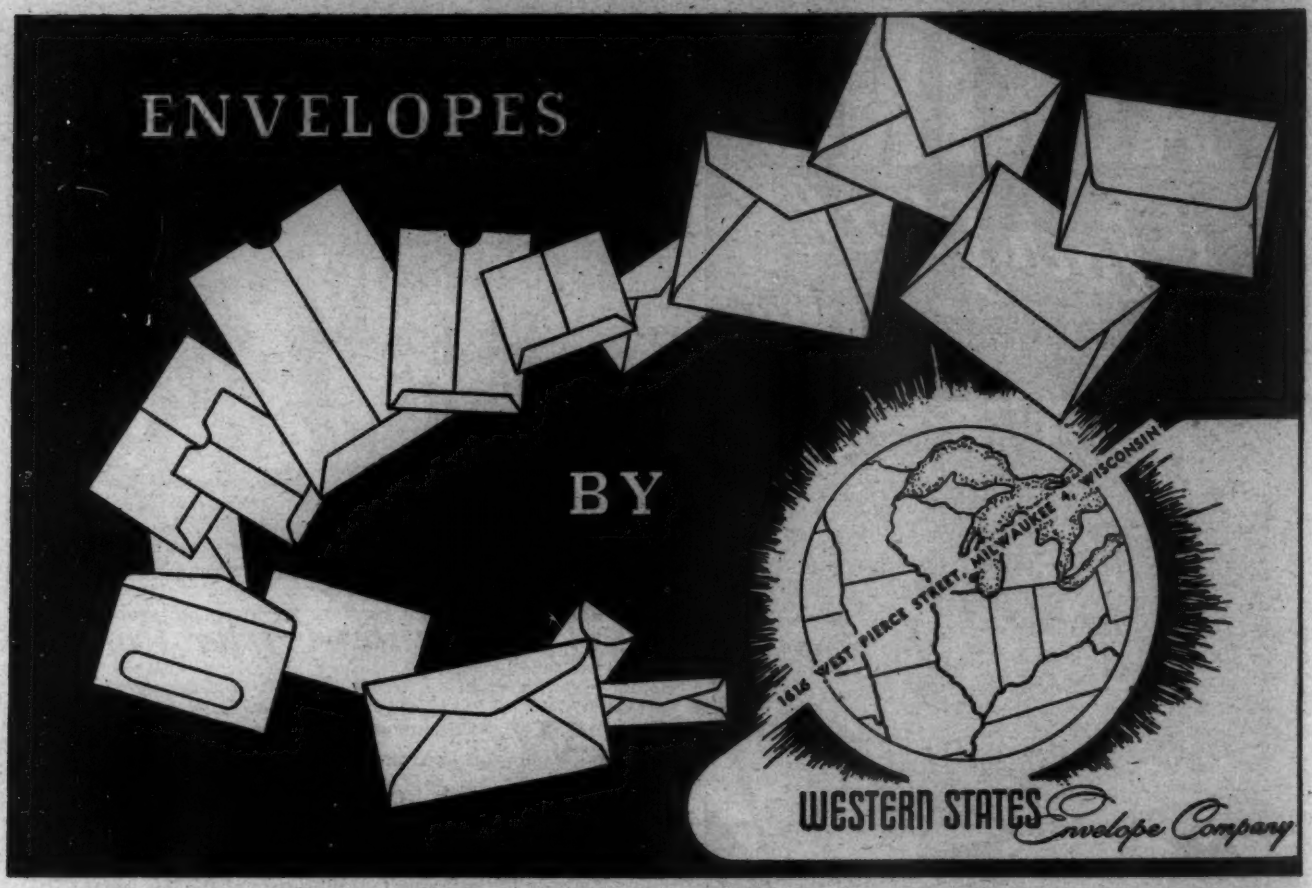
A turn of the knob to the right locks the motor firmly to the base . . . a half turn to the left engages the exclusive Carter Calibrated Thread Adjustment . . . and a full turn to the left permits you to *slide* the motor up or down for quick depth adjustments.

This new base combines the advantages of precision-calibrated threading with that of speed and ease of adjustment. One turn of the motor changes the depth of the cut *exactly* 1/16" . . . a quarter-turn, 1/64". There are 16 threads per inch, making it easy to set the unit for any desired cut.

Write for full information on this latest Carter improvement. Stanley Electric Tools, Stanley-Carter Sales Department, 112 Elm Street, New Britain, Connecticut.

STANLEY
Trade Mark

HARDWARE · HAND TOOLS · ELECTRIC TOOLS



(Continued from page 64A)

more than a listing of equipment. It also includes a "catalog of uses," showing how portable hydraulic power tools can speed work in maintenance and production.

This 24-page book covers Porto-Power hydraulic units in 2-, 4-, 7-, 10-, 20-, and 50-ton sizes, along with attachments for push, pull, press, clamp, bend and lift operations. Pipe benders are included, along with gauge equipment which adapts hydraulic power to laboratory uses.

This firm has also just published a Blackhawk Jack Catalog No. J-46, which describes hand jacks up to 100-ton capacities, together with gauge-equipped jacks and wheeled floor jacks.

For either or both of these catalogs write Blackhawk Mfg. Co., Catalog Dept., Milwaukee 1, Wis.

For brief reference use IAVE—0305.

CATALOG OF PROJECT PATTERNS

The Pattern Mart, 5735 Wintrop Ave., Cincinnati 24, Ohio, has just made available a catalog of 861 paper patterns of projects for homecrafters. These patterns are divided into the following classifications: wall brackets and shelves; boxes; miscellaneous; toys and games; chests and cabinets; tables and stands; lawn figures and ornaments; lamps; chairs, footstools, and benches; frames; book ends; holders and racks; plaques; book and magazine racks; silhouettes; flower pot shelves; baskets, and stands; corner brackets and shelves; and designs and stencils.

The firm can also furnish the required materials for many of the projects.

For brief reference use IAVE—0306.

NEW DUAL DRIVE LATHE

The R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio, have just published a booklet which portrays their dual drive lathe in an exceptionally clear manner. Utilizing transparent plastic as the medium on which the picture of their new lathe is printed, the reader can open successive pages and get a clear view of the complete construction of the entire lathe. In this way the construction, operation, inspection, and maintenance of the LeBlond Durol Drive Lathe can be readily studied.

The Dual Drive Lathe is especially designed for use in light manufacturing, toolrooms, technical high schools, vocational schools, and engineering colleges.

For brief reference use IAVE—0307.

NEW NO. 2 MI MILLING MACHINE

The Cincinnati Milling Machine Co., Cincinnati, Ohio, has announced its new No. 2 MI milling machine, which is suitable for a wide variety of milling operations. This machine has 16 spindle speeds, 16 feeds, independent and centralized feed control levers, enclosed knee with apron extension and enclosed motor and built-in electrical controls, and is provided with automatic and oil shot lubrication, quick-adjusting micrometer dials, enclosed rotating shafts, built-in coolant pump, adjustable starting lever, and live rapid traverse. An attractive descriptive booklet on this machine may be obtained by writing to the Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

For brief reference use IAVE—0308.

YOUR LIFE IN THE MACHINE WORLD

A 19 by 25-in. pictorial wall chart in colors, supplemented by a 56-page booklet titled "Your Life in the Machine World," presents in an interesting manner the story of man's advance from the prehistoric era to our modern industrial age.

This material presents excellent reference material for the related subjects classes.

Copies may be obtained by writing to The DoAll Company, 254 North Laurel Ave., Des Plaines, Ill.

For brief reference use IAVE—0309.

NEW GENERAL WELDING AND CUTTING PRODUCTS CATALOG

The Air Reduction Sales Company has announced publication of a new 64-page general welding and cutting products catalog.

The catalog is divided into two sections: one for oxyacetylene welding and cutting gases, equipment and supplies; the other for arc welding machines, accessories and electrodes. The last ten pages of the catalog are devoted to specially compiled electrode price lists.

A free copy may be obtained by writing to Air Reduction Sales Company, 60 East 42nd Street, New York 17, N. Y.

For brief reference use IAVE—0310.

DITTO BUYS NEW PLANT

Ditto, Inc., Chicago-New York, business systems manufacturers, announces the purchase of a new manufacturing plant at 4600 West Parker Ave., Chicago. It will be known as Plant No. 5.

Details of the purchase of the new plant have been completed, and transfer of machine manufacturing operations from Plant No. 1 at Harrison and Oakley began Friday, November 29. The vacated space in Plant No. 1 will be reallocated to other departments to relieve acute congestion.

For brief reference use IAVE—0311.

NEW BRANCH ESTABLISHED

Snap-on Tools Corporation of Kenosha, Wis., announces the opening of its thirty-ninth branch office at 210 South Poplar St., Charlotte, N. C.

George Weitz, formerly with the Jacksonville, Fla., branch, will manage the new branch.

Specialized tool service will be offered for the first time to the rapidly growing Carolina textile industry. Snap-on already offers complete tool service to automotive, aviation, marine, and railroad mechanics.

(Continued on page 69A)

"YANKEE" VISES

TEACH ACCURACY

Start-to-finish work holding encourages precision . . .

● Your work is always accurately lined up in a "Yankee" Vise. Carefully machined . . . top, bottom, sides and front end for use in any position. Makes convenient, economical jig. For handling rounds, each vise is furnished with V-grooved, hardened steel block. Four sizes of "Yankee" Vises . . . 1½", 2", 2¾" and 4" jaw widths. Same sizes also available with detachable swivel base for bench use.

Is the "Yankee" Tool Book on your shop shelf? FREE!

YANKEE TOOLS NOW A PART OF STANLEY THE TOOL BOX OF THE WORLD

NORTH BROS. MFG. CO.
Philadelphia 33, Pa.

WALLACE
"MACHINE-OF-THE-MONTH"

No. 28 SHAPER

2 H.P. geared motor rotates spindle 10,000 r.p.m.

Reversing switch. Capacity for large cutters up to 2¾" wide. Vertical spindle adjustment 1½". Collet for routing bits extra.

For fast, smooth shaping work, this 10,000 r.p.m. gear-drive Shaper is without equal! Cutters and knives available for every kind of moulding and shaping operation. Adapter and collet permits use of small routing bits and cutters, adding extra versatility.

Cuts equally well with and against grain and on hard or soft wood.

Write today for detailed bulletins and prices on the Wallace No. 28 Hy-Gear Shaper. We also manufacture quality Universal Saws, Radial Arm Saws, Bandsaws, Jointers, Mortisers, Lathes, Oilstone Grinders, etc.

J. D. WALLACE & COMPANY
140 S. CALIFORNIA AVE. CHICAGO, ILL.

FOLEY *Automatic* SAW FILER

Trains Your Students Better-- DOUBLES the Life of Your Saws

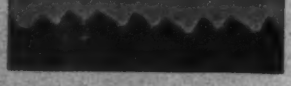
Nothing is more important to the success of your training program than your saws. Students dull them fast—they need sharpening often.

The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cut circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner—stay sharp longer.

With a Foley Automatic Saw Filer you can sharpen your saws more perfectly than is possible by hand. You can do it quicker, — and your saws will stay sharp longer. Your students will turn out better work with sharp saws. ALSO by keeping your saws sharp with a Foley, — you will easily double their cutting life and have less breakage, reducing replacements to a minimum.

Train your students to file saws on a Foley, for they will find thousands of Foley Saw Filers used in industry, Army, Navy, Air Corps, etc. Hundreds of schools and colleges use them to save on saw filing costs and replacement expense.

The FOLEY SAW FILER *Makes . . .*



an OLD SAW

LIKE NEW!

TYPICAL SCHOOL USERS
Berea College, Berea, Ky., Board of Education, Cleveland, Ohio; Boys Technical H. S., Milwaukee, Wis.; Charleroi School District; Charleroi, Pa.; Redlands Public Schools, Redlands, Calif., Stout Institute, Menomonie, Wis.

30-DAY TRIAL OFFER
You may have the privilege of using a Foley Saw Filer in your own shop for 30 days, — and see for yourself its training advantages and operating economies. Send coupon for details.

Send in this Coupon

FOLEY MFG. CO., 18 2nd Street N.E., Minneapolis 13, Minn.
Please send literature on the Foley Automatic Saw Filer and details of your 30-Day Trial.

Name .....

Address .....

Print-Shop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- *a*) Hand, small size
- *b*) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- *a*) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *i*) Type, complete with 24 full-size California job cases, double work band, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.
- *l*) Storage for cuts

CANS
- *a*) Benzine, pint size
- *b*) Benzine, 5-gal. size
- *c*) Kerosene, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

CASES
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼ size, for ornamental borders
- *c*) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- *d*) Metal furniture, to hold laborsaving fonts
- *e*) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- *a*) For platen presses
- *b*) For cylinder presses

CHASES
- *a*) For each size of platen press
- *b*) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- *a*) Lead and rule
- *b*) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- *c*) Paper, lever type, 26 in. or 30 in.
- *d*) Paper, lever type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

DESK
- *a*) Bindery, 80 by 36 in.
- *b*) Drying rack
- *c*) Imposing, 51 by 39
- *d*) Make-ready, 32 by 24 in.
- *e*) Paper cutters, 80 by 36 in.
- *f*) Proofreaders
- *g*) Teachers

DRYING RACKS
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- *a*) 12 by 18 in., with iron top, including reglets and furniture
- *b*) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 by 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- *a*) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- *b*) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- *a*) Overlay, for make ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

LEADER BOXES

LEADERS
- *a*) 6, 8, and 10 pt., fine dot
- *b*) 8 and 10 pt., hyphen

LINE GAUGES
- *a*) Metal, brass, or steel
- *b*) Wood

MALLET

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- *a*) For use on presses
- *b*) Hand machines

ORNAMENTS
- *a*) Assorted floral and decorative designs
- *b*) Border, 6 and 12 pt., decorative

PAPER-DRILLING MACHINE

PERFORATOR
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

PLANER
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple, with leather top

PRESSES
- *a*) Cylinder, two revolution, four roller, 17 by 22, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 by 18, with cabinet
- *f*) Proof, 20 by 24, with cabinet
- *g*) Proof, 23 by 24½ with cabinet
- *h*) Tableting

PUNCH
- *a*) Foot power, multiple with assorted punches
- *b*) Lever, two die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- *a*) 2 pt., laborsaving, hair line, side face
- *b*) 2 pt., laborsaving, 1 pt. side face
- *c*) 1 pt., laborsaving, 1 pt. face
- *d*) 2 pt., laborsaving, double face

SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SILK-SCREEN UNIT

SPACING MATERIAL
- *a*) Iron furniture, as selected
- *b*) Leads, laborsaving, 2 pt.
- *c*) Leads, 2-ft. strips, 2 pt.
- *d*) Slugs, laborsaving, 6 pt.
- *e*) Slugs, 2-ft. strips, 6 pt.
- *f*) Spaces and quads
- *g*) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STEREOTYPING UNIT, 8 by 12 in.

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

TYPE
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job, lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt.; 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *i*) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- *k*) Job, heavy copperplate Gothic

(Continued on page 70A)

News Notes

♦ The U. S. Department of Commerce has just issued a new booklet entitled, "Establishing and Operating a Small Printshop," which tells how to run a print shop efficiently, how to earn profits, and how to get satisfaction and security for the future. The booklet points out that the successful printer must have had a background of some major experience in the industry. This means that he must have had years of experience as a journeyman, preferably as a foreman, or in some other supervisory capacity. Next to experience, he must also have intelligence, education, and good business sense.

♦ The U. S. Department of Commerce has just issued a booklet entitled, "Establishing and Operating a Weekly Newspaper," which tells how to run a newspaper efficiently. The booklet points out that for men who have ideas, some experience in the field, and who do not fear plenty of hard work, an opportunity awaits them in the weekly and small daily newspaper field.

♦ The annual meeting of the Board of Trustees of The American Designers' Institute was held in New York on January 21 at the Hotel New Weston.

The following national officers were elected for the coming year: president, Alexander J. Kostellow, New York; vice-presidents, Ruth Gerth, San Francisco, Calif.; and Stewart Pike, Philadelphia, Pa.; treasurer, Lionel C. Algoren, Chicago, Ill.; secretary, Ann Franke, New York.

♦ The one-story frame vocational agriculture building at Monroe City, Mo., was wrecked by a fire which was caused by an explosion. Four students were killed, while the instructor and five other students were injured.

♦ The school board of Altoona, Pa., during the school year 1945–46, established a trowel trades shop, to include plastering, brickwork, cement, and stone masonry. The classes were housed in the Emerson School basement for retarded boys from

(Continued on next page)

Tech Training

WE BELIEVE THE MAN IS RIGHT. In fact we are sure that a comparison will also prove to you that a textbook is the *watchdog of the classroom.*

ONE OF OUR REPRESENTATIVES, Harry Sears, recently told us about a prominent city vocational director whom he called on. This director compared classes that used a textbook with those where the instructor "had it in his head." The classes that used a book were so far ahead of the others that the director concluded: "If the instructor can't use a textbook, I will hire someone who can. . . . A textbook is the watchdog of the classroom—insurance against wasted time due to lack of organization."

DISCOURAGE INITIATIVE? As a matter of fact there was an intimation that those teachers who used textbooks were generally the ones that were most alert to new developments in the industrial and educational fields. A good industrial background is an important asset—particularly when used with good educational tools.

IMPORTANT PUBLICATIONS

that you may have overlooked

AIR CONDITIONING
1. Furnaces and Unit Heaters..... $3.50
2. Heating and Ventilating..... 4.50

AUTOMOTIVE
3. Automobile Engines..... 4.75
4. Chassis and Power Transmission..... 4.75

AVIATION
5. Aircraft Sheet Metal Blueprint Reading.. 2.50
6. Aircraft Sheet Metal Work..... 3.75

BUILDING TRADES
7. Stair Building..... 2.50
8. Steam and Hot Water Fittings..... 2.25

BUSINESS
9. Everyday Problems in Economics..... 4.00
10. Fundamentals of Business Law..... 3.00

DIESEL
11. Diesel Electric Plants..... 3.75
12. High-Speed Diesel Engines..... 2.50

DRAFTING
13. Architectural Drawing and Detailing..... 2.50
14. Mechanical Drawing Workbook..... 2.75

ELECTRICITY
15. Electrical and Radio Dictionary..... 1.25
16. Interior Electric Wiring and Estimating.. 2.75

MACHINE AND ALLIED SUBJECTS
17. Forging Practice 1.50
18. Machine Design 3.50
19. Mechanism 3.75
20. Machine Tool Guide..... 8.00
21. Metallurgy 5.00

MATHEMATICS
22. Plane Trigonometry Made Plain..... 3.00
23. Slide Rule Simplified (with rule)..... 4.00

PLASTICS
24. Plastics 5.00
25. Plastic Mold Engineering..... 7.00

RAILROAD
26. Diesel Locomotives—Electrical Equipment 4.00
27. Diesel Locomotives—Mechanical Equipment 4.50

SHIP BUILDING
28. Shipbuilding Blueprint Reading..... 3.00
29. Shipbuilding Terms ..... .50

AMERICAN TECHNICAL SOCIETY

Please send the books circled below for 30 days examination. If any of the books are adopted and 12 or more copies ordered, I will retain the adopted books as desk copies; otherwise I will return them or remit less the educational discount.

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15 16 17 18 19 20 21 22 23 24
25 26 27 28

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School .....

School Address .....

Drexel Avenue at 58th Street
Dept. H.S. 278 Chicago 37, Ill.

AMERICAN TECHNICAL SOCIETY

(Continued from page 66A)

NEW REGIONAL SALES SUPERVISOR

L. G. Stewart has been appointed Pacific Coast regional sales supervisor for the school films division of the Jam Handy Organization.

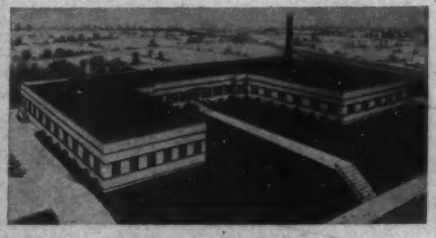
Many years of experience with the training activities of the Jam Handy Organization have qualified Mr. Stewart for his new position. Although his headquarters are now in the Hollywood office, Mr. Stewart has served the organization as a field utilization operative in every section of the country.

The Jam Handy organization has named Nate Quillen distributor in the eastern and southern sections of Ohio for their School Films Division.

Mr. Quillen brings to his new position 14 years of experience with the Jam Handy organization in the field of audio-visual aids and their utilization.

DOALL COMPANY OCCUPIES NEW QUARTERS

The general sales offices of both the DoAll Company and the DoAll International Company, distributors of DoAll products and machine tools,



The DoAll Company, Des Plaines, Ill.

celebrated 15 years of continued growth and expansion by moving their entire facilities into new streamlined quarters at Des Plaines, Ill., January 15, 1947.

The new location at 254 North Laurel Ave., Des Plaines, Ill., will provide for the unification of their entire sales activities. This will also bring the DoAll Company's sales activities more centrally situated among its sales outlets and suppliers of DoAll machine tools and products.

OHLEN-BISHOP'S NEW PLANT

The Ohlen-Bishop Mfg. Co., Columbus, Ohio, manufacturers of saws and edge tools, has plans for a new plant in Columbus, involving an expenditure of approximately $1,000,000.

An architectural sketch of the new plant of the Ohlen-Bishop Manufacturing Company

The plant will be located on a 27-acre tract, on Kinnear Road, between Kenny and North Starr Roads. The site has been cleared and work is going forward on the construction. It will include a two-story and basement office building of modern design, and a spacious factory area.

The company was originally known as the James Ohlen and Sons Mfg. Co. Founded in 1852, by James Ohlen, it has specialized in the production of so-called "mill" saws. In 1918 it expanded its line and acquired by purchase the plants and good will of the George H. Bishop Company. With a rounded-out saw line, the company has been reorganized and has taken the name of the Ohlen-Bishop Mfg. Co. Since 1940 the demand for its products has grown to such an extent that the new plant was decided on.

SKILSAW BUYS PNEUMATIC TOOL FIRM IN AURORA

Skilsaw, Inc., Chicago manufacturer of portable electric tools, has announced the purchase of the Forss Pneumatic Tool Company of Aurora, Ill., manufacturer of a general line of small, portable pneumatic tools.

As a result of the acquisition, Skilsaw will be able to supplement its line of portable electric tools with a line of portable pneumatic tools.

The Forss Pneumatic Tool Company was founded in 1943 by F. P. Forss, who for 37 years was identified with the Independent Pneumatic Tool Company of Chicago, and his son, John. Both will remain with the Skilsaw organization and will be in charge of pneumatic tool manufacturing operations at the Aurora plant.

The pneumatic tools will be sold direct to distributors, along with the Skilsaw line, through the latter's sales organization.

NEWS NOTES

(Continued from previous page)

the Roosevelt Junior High School. These boys had made poor school adjustments. Shops of the same type, working with wood and metal, were in operation in the Keith Junior High School, and for wood, electric, and general metal in the senior high school.

The boys constructed a cinder block paint room in the Roosevelt school shop, a brick wall of 2500 bricks in the Lincoln basement, and several cinder block walls in the Emerson basement, besides regular trade projects.

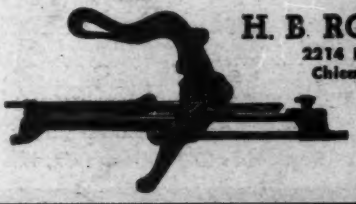
(Continued on page 75A)

OF VITAL *Importance*

Lead and Rule Cutters and Mitering Machines are of vital importance. They should be checked frequently and repaired or replaced if there is a QUESTION of accuracy.

New ROUSE tools will often solve the problem of work-ups, bad corners, and springy forms. Completely equip your composing room with ROUSE tools, NOW.

See your nearest dealer, or write for circulars today.



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(Continued from page 68A)

— 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
l) Wood, condensed Gothic — 8, 12, 15, and 18 line
m) 10 pt. line leaders, 4 dots to the em
n) 10 pt. braces and dashes
o) 10 pt. fractions
p) 10 pt. references
q) Parentheses and brackets
r) 2 pt. laborsaving leads, 4 to 25 picas
s) 6 pt. laborsaving slugs, 4 to 25 picas
t) 2 pt. laborsaving brass rule
u) 2 pt. miters for rule
v) Laborsaving metal furniture
w) Thin spaces with quarter-size case

TYPESETTING MACHINES
a) Either linotype or intertype, 2 or 3 magazines, and molds
b) Matrices for same, 6, 8, 10, and 12 point, as selected

VISUAL AID CHARTS

Print-Shop Supplies

BENZINE OR GASOLINE — for cleaning type or presses

BINDERY TAPE — 2 in. wide, brown or black

GOLD BRONZE — pale

INK
a) Bond, black, for bond papers
b) Book, black, for school papers, etc.
c) Cover, colors as selected
d) Dryers and compounds, as selected
e) Half tone, black
f) Job, colors as selected
g) Metallic, gold and silver
h) Process, black, red, yellow, blue

KEROSINE — for cleaning rollers

PADDING CEMENT
a) Cold
b) Hot

PAPER
a) Bond, fine grade, 17 by 22 — 20, white
b) Bond, medium grade, 17 by 22 — 20, white
c) Bond, sulphite, 17 by 22 — 20, white
d) Bond, sulphite, 17 by 22 — 20, colors as selected
e) Book, enamel, 25 by 38 — 80, white
f) Book, machine finish, 25 by 38 — 80, white
g) Book, eggshell finish, 25 by 38 — 60, white
h) Cover, as selected, 20 by 26, medium
i) Card Bristol, fine grade, 22 by 28 — 4 ply, white
j) Index Bristol, medium grade, 25½ by 30½ — 110, white
l) Index Bristol, medium grade, 25½ by 30½ — 140, white
m) Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 by 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

PASTE
a) Bindery
b) Make ready

SILK-SCREEN SUPPLIES consisting of:
a) Silk-screen process paste paint, 1 each of the following colors: toluidine red, strontian yellow, ultramarine blue, medium green, rich brown, orange, purple, white, and black
b) Solvent profilm in 11- by 14-in. sheets
c) 8-in. synthetic squeegee
d) 11-in. synthetic squeegee
e) No-clog varnish
f) Film solvent
g) Stencil filler
h) Filler remover
i) Stencil knife
k) Fiber guides
l) Red sable brush — ½ in.
m) Putty knife
n) Frame tape

TWINE — cotton, for tying jobs

WIRE STITCHING
a) No. 28 round wire for stitcher
b) Wire staples, ¾ in.

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER

BEAM COMPASS

BENCH BRUSHES

BLACKBOARD
a) Permanent or portable

b) Compass, 15 in., with locking device
c) Drawing set: T square, straightedge, triangle, and protractor

BLUEPRINT
a) Frame or machine
b) Washing trays or washer
c) Paper tube, airtight
d) Drying rack or dryer

BOOKCASE

CABINET
a) For filing drawings

(Continued on page 72A)

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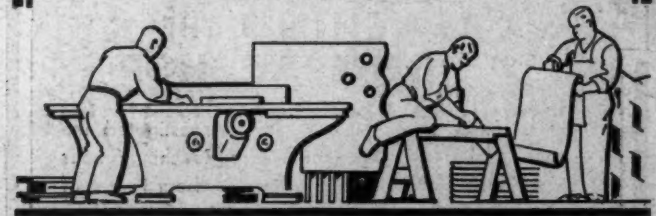

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(Continued from page 70A)

b) For storing drawing boards
c) For storing drawing instruments
d) For storing models

CALIPERS — 6 in. and 8 in., inside and outside
CHAIR — teacher's
DESK — teacher's
DIVIDERS — proportional
DRAFTING MACHINE — and accessories
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DRAWING BOARDS — large
DRAWING-BOARD SUPPORTS — to be set on or attached to woodworker's bench
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a) For students
b) For teachers
INK-BOTTLE HOLDER
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LETTERING ANGLES
LETTERING PENS — assortment of 12
LEVEL OR TRANSIT — builders' for architectural students
LEVELING ROD — for use with the transit
MACHINISTS' COMBINATION SET — 12 in.
MARKING PINS — for use with measuring tape, for architectural students
MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
a) For cutting and trimming drawings and blueprints
b) For disassembling and reassembling machine parts and models
TAPELINE
a) 100 ft., steel, for architectural students
b) 50 ft., steel or metallic
TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
a) 30-60 deg., 14 in. transparent
b) 45 deg., 10 in. transparent
TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK

To be provided by, or for, each student

Drafting—Small Equipment

DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30-60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
a) Paper, 36 in. wide
b) Writing fluid
PAPER
a) Cross section, 8½ by 11 in.
b) Detail, 24 by 36 in.
c) Drawing, 24 by 36 in.
d) Isometric, 7 by 10 in.
e) Tracing, 36 in.
POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
a) Fixing salts
b) Paper, 36 in.
c) Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student

ERASERS
a) Cleaning
b) Ink
c) Pencil
INK
a) Black, waterproof
b) Colored, if required
PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H
PENCIL POINTER PAD
THUMBTACKS OR SCOTCH TAPE

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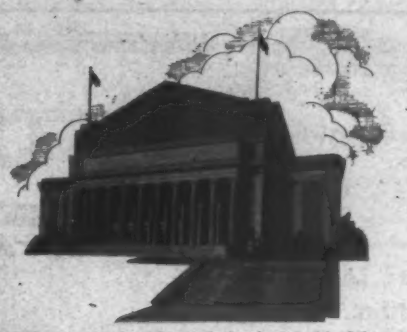

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The Dean of the Graduate School, 234 Administration Building, will supply a Bulletin of General Announcement and a blank of "Application for Admission".

Bulletins and application blanks are now available from Director of Summer Session, 802 Administration Building.

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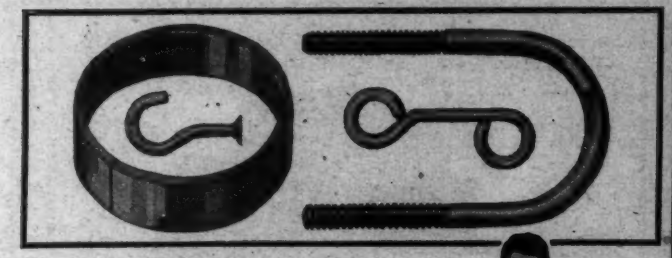

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(Continued from page 69A)

A follow-up study disclosed that the great majority of the boys were no longer rebellious, troublesome, or delinquent, and that several of them obtained out-of-school employment in the field of their training.

♦ To stimulate graduate study in science and engineering, Illinois Institute of Technology is again offering fellowships, scholarships, and assistantships for the term beginning September 22, 1947.

Among the fellowships permitting advanced study with unusual experience in special fields of research are: the Illinois Institute of Technology Research Fellowships; the Universe Oil Products Fellowship in Chemistry; the Westinghouse Educational Foundation Fellowship in Power Systems Engineering; the Institute of Gas Technology Fellowships; and the Armour Research Foundation Industrial Research Fellowships.

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♦ "Summer Storm," is a new black and white sound motion picture produced by the School Service Department of Westinghouse Electric Corporation.

It is recommended for classes in physics and social studies and for general assembly groups, and describes the hidden menace of a thunderstorm to the security of present-day electrical living.

Schools may borrow this film in 16mm. or 35mm., free except for transportation through the School Service Department, Westinghouse Electric Corporation, 306 Fourth Ave., Box 1017, Pittsburgh 30, Pa.

♦ Opening of the department of industrial arts again after four years of inactive status is announced at the University of North Dakota. The new program includes a separate building with modernized equipment and revision of course content to serve teacher training and service needs.

Graduate and former lieutenant (jg) in the U. S. Navy, Marvin Poyzer, is new head of the department.

♦ A 154-page report on German industrial safety practices and research was written by the Office of Technical Services investigators Edward G. Meiter and Albert J. Toering. They visited factories, safety research centers, university laboratories, and government offices, and noted ideas in safety practices and research which might aid American industry.

Unlike American practice, German safety regulations emphasize protection of machines rather than the direct protection of personnel. The investigators attributed this difference to less concern over workers' injuries as well as more extensive self-protection training given to apprentices.

When the apprentice completes his training he is already acquainted with the safety practices of his trade and does not require the same safety supervision as an American worker, whose training is often limited to the operation of a few specialized machines. Consequently, when a German worker fails to use available safety devices, it is assumed that he knowingly risks the dangers involved.

Most machine guards are made by the operating plants themselves and vary widely in design and efficiency. Limited use is made of automatic feeds for punch presses or other machines. One good principle required by law is the special guarding of grinding wheels.

The report includes detailed descriptions of government regulatory activity, safety research centers, legal first aid requirements, and standard emergency medication and methods used in large factories.

The report (PB-6364: *Industrial Safety in Germany;* microfilm, $2; photostat, $11; 154 pages, including photographs, drawings, and tables; dated November, 1945) also contains formulas and methods of preparing various chemical indicators.

Orders for the report, accompanied by check or money order, payable to the Treasurer of the United States, should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C.

♦ The Moore Special Tool Company of Bridgeport, Conn., has just published a 448-page handbook, fully illustrated entitled "Precision Hole Location for Interchangeability in Toolmaking and Production." It is an authoritative and complete textbook on this phase of toolmaking.

While it is priced at $5.00, the Moore Company will sell it to the metalworking industry at $3.00 in the U.S.A.; $3.50 elsewhere. The 184 pages of Woodworth Tables for converting holes from 3 to 100, on circles to rectangular co-ordinates alone, make this book exceedingly handy for the practical toolmaker.

New Publications

Design — An Introduction

By Janet K. Smith. Cloth, 170 pp., 8¾ by 11 in., illus., $3.50. Ziff-Davis Publishing Co., Chicago and New York.

A book on art and design with explanatory sections and illustrations on the various systems of representation and various concepts of design. Art elements (line, shape, tone, color, texture,

(Continued on page 83A)

DIRECTORY OF MANUFACTURERS' PRODUCTS

This directory is published as a convenient guide to sources of supply, covering the products of manufacturers carrying product information in this ANNUAL NUMBER. For alphabetical index of manufacturers' advertising see page 85A. To obtain products not included in this directory, quotations or additional information to help you make up your specifications, lists of equipment, etc., address Industrial-Arts Service Division, or use coupon on page 85.

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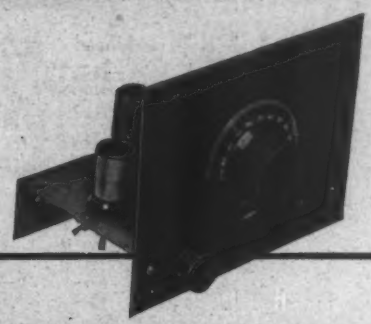

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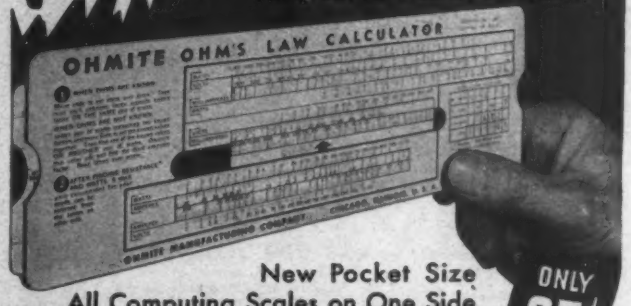

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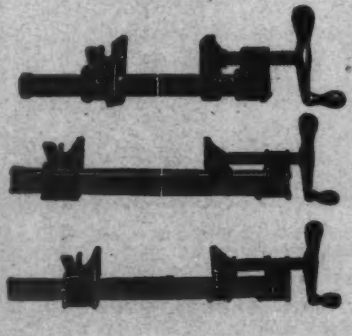

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(Continued from page 75A)

mass, and space) as well as the art principles (rhythm, balance, and emphasis) also are discussed. The book also contains a glossary and a comprehensive bibliography.

Automotive Mechanics

By William H. Crouse. Cloth, 673 pp., 6⅛ by 9⅛ in., illus., $3.60. McGraw-Hill Book Co., Inc., New York City.

A textbook for auto mechanics. It contains a great number of illustrations and shows step-by-step procedures for locating and correcting faults and troubles.

The book also lists the visual aids — motion pictures and film strips — that may be used to make the presentation of the course more effective.

Building a Log Cabin

By Ben. Hunt. Cloth, 100 pp., 6⅞ by 10⅜ in., illus. $2.75. The Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis.

An excellent book for the outdoor man who wants to build his own log cabin. The author of this book portrays his own experiences in this book, and gives excellent suggestions in choosing the right site, get the material, build the foundations, lay up the walls, put on the roof, and arrange for and put in windows, doors, floors, stairs, and ceilings.

He also explains how it is well to erect the fireplace before laying up the walls, and how to make fixtures that fit into the log-cabin setting, how to recondition old log cabins, erect outdoor fireplaces, and the like.

The book also will interest that large family of readers who would like to build a log cabin but have neither the time nor the place to engage in this pioneering undertaking.

Human Factors in Management

Edited by Schuyler Dean Hoslett. Cloth, 322 pp., 6¼ by 9⅛ in., $4. Park College Press, Parkville, Mo.

A book which deals with the human relations problems of the executive and the worker.

It consists of three parts the first of which discusses the nature of leadership, the second shows how leaders should be trained, and the third presents some studies in human relations.

It is a book from which much profitable information may be drawn by both management and labor.

Drafting for Electronics

By L. F. B. Carini. Cloth, 211 pp., 6⅛ by 9¼ in., illus., $2.50. McGraw-Hill Book Co., New York City.

A text which prepares the beginner on how to draw the diagrams used in the field of electronics. It covers the field of schematic drafting quite thoroughly in chapters titled schematic delineation, schematic circuit projection, and schematic patent drawings.

It also shows how this schematic drawing is applied to industrial electronics, and how to check drawings.

The book also contains bibliographies of correlated motion pictures and film strips.

Machine Design

By Louis J. Bradford and Paul B. Eaton. Cloth, 283 pp., 5¾ by 8⅛ in., illus., $3.25. John Wiley and Sons, New York City.

This is a revision of a book that has gone through five editions. The authors present the fundamentals of machine design in a clear and concise manner.

The contents present the fundamental definitions and considerations and then discuss friction and lubrication, bearings and sliding surfaces, clutches and brakes, shafts, force and shrink fits, screws and fastenings, gears, belts and chains, springs, and some miscellaneous machine elements.

Basic Mathematics for Technical Courses

By Clarence E. Tuites. Cloth, 343 pp., 6⅜ by 9¼ in., with 132 additional pages of tables, $5. Prentice-Hall, Inc., New York, N. Y.

A book designed for students in technical high schools and junior colleges. Representative problems from the various technical fields have been chosen for the content.

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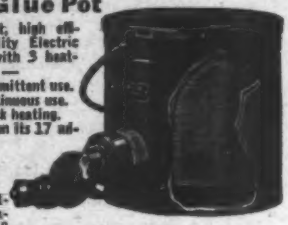

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Jewelry Making and Design

By Augustus F. Rose and Antonio Cirino. Cloth, 409 pp., 6¼ by 9¼ in., illus., $6.95. The Davis Press, Inc., Worcester, Mass.

A revision of a book first written by Augustus F. Rose, well known in the teaching fraternity as an untiring and enthusiastic teacher who combined artistry and skill to an uncommon degree.

The present book is a thoroughly revised edition, prepared by Rose and his coauthor Cirino. While the book was still on the press, Mr. Rose died. The text contains numerous illustrations of processes and instructions, 25 problems and projects, and many pages of instructions on how to design and produce jewelry that is beautiful and well made.

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By Maurice R. Davie. Paper, 32 pp., 10 cents. Published by Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

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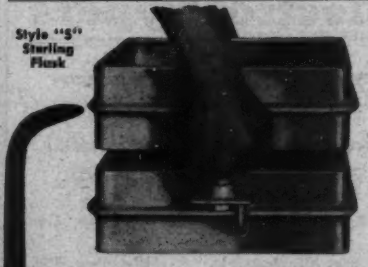

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Code No.		Page No.
30	Adjustable Clamp Company	81A
31	Air Reduction Sales Co.	10A
32	Aluminum Company of America	25A
33	American Gas Furnace	83A
34	American Handicrafts Co.	84A
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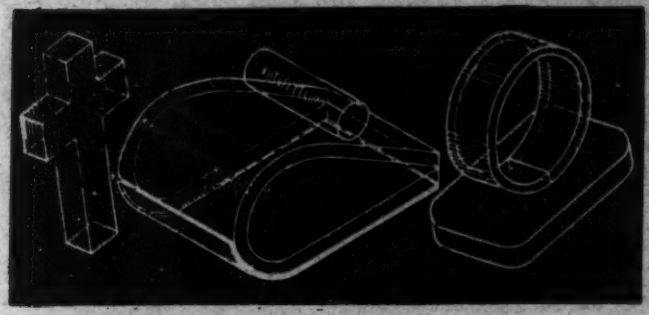

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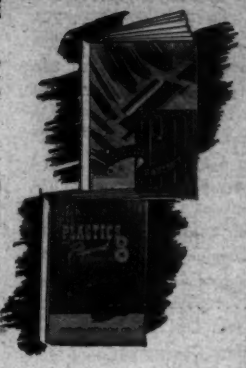

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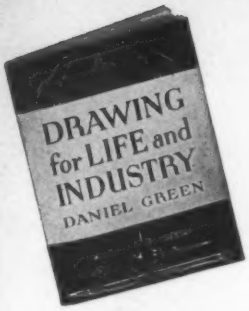

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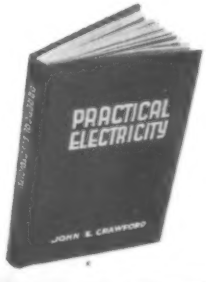

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